GATES LEARJET CORPORATION

maintenance manual

CHAPTER

34

NAVIGATION

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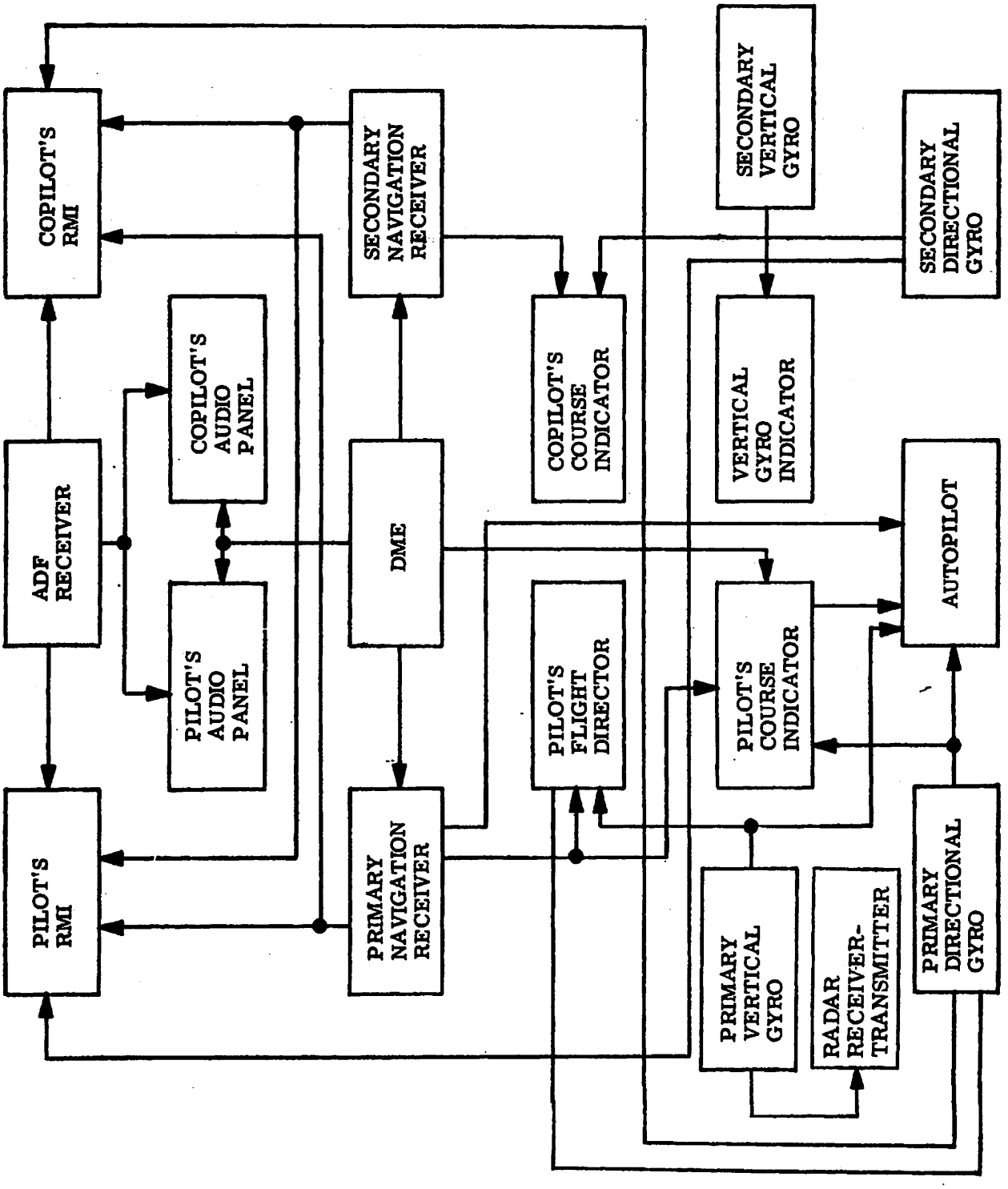
NAVIGATION - DESCRIPTION AND OPERATION

1. General
   A. The aircraft navigation systems includes those components and systems which provide attitude, altitude, direction, speed, flight guidance and enroute navigational information.
   B. Figure 1 illustrates in block diagram for the navigational systems.



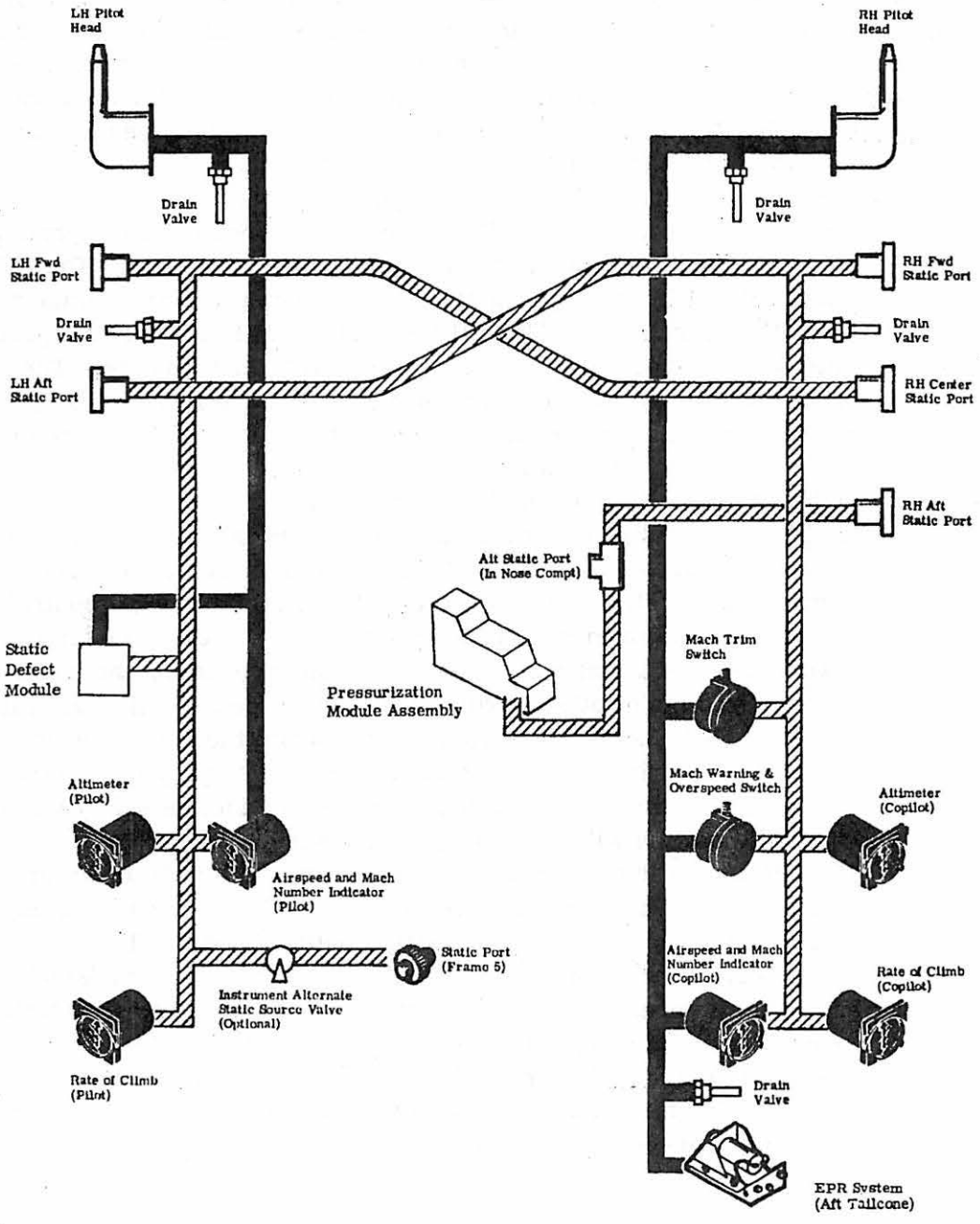
Navigation System Block Diagram
Figure 1

FLIGHT ENVIRONMENT DATA - DESCRIPTION AND OPERATION

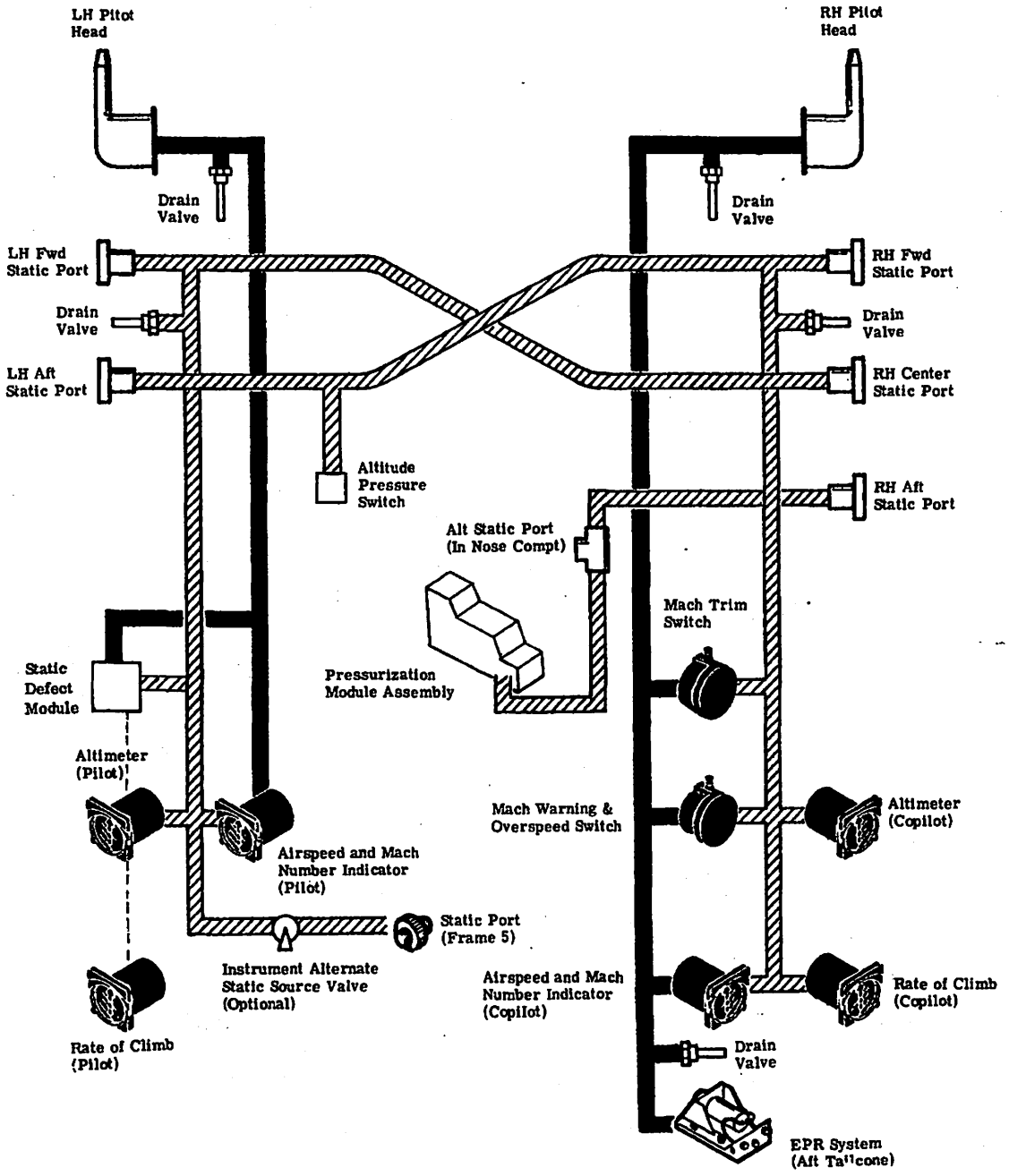
1. General
   A. The flight environment data system consists of the pitot and static system which senses and supplies air pressure to the air data instruments.
   B. The air data instruments, using pitot and static air pressure include the following: rate of climb indicator, airspeed/mach indicator, altimeter and mach warning system.
   C. Other aircraft systems utilizing pitot and static air pressure are the cabin pressurization control and autopilot systems.
      (1) Refer to 22-00-00 for further information on the autopilot system.
      (2) Refer to 21-30-00 for further information on the cabin pressurization system.

PITOT AND STATIC SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. Pitot pressure is obtained from two pitot heads, one located on each side of the nose compartment. Each pitot head is equipped with an electrical heating element to prevent moisture from freezing on the mast and/or obstructing the heads. For further information on the electrical controls for the pitot heads, refer to 30-30-00. Drain valves are installed in the pitot lines forward of frame 5 to drain any accumulation of water in the lines.
   B. Static pressure is sensed from 10 static ports.
      (1) The LH forward, LH aft, RH forward and RH center static ports provide static pressure for the pilot's and copilot's instruments. The RH forward and LH aft static ports are interconnected and are plumbed to the copilot's instruments. The LH forward and RH center static ports are interconnected and are plumbed to the pilot's instruments. The static ports are electrically heated to prevent moisture from freezing and obstructing the port openings. For further information on the electrical controls for the static ports, refer to 30-30-00. Drain valves are installed to drain any accumulation of moisture.
      (2) An instrument alternate static source system is provided as a backup should blockage of the pilot's static ports or tubes occur. The instrument alternate static source system consists of a manual control valve mounted on the lower edge of the pilot's panel, a union installed in frame 5 which acts as a static port, and the hoses connecting the union and control valve to the pilot's instrument static system. Setting the valve handle to OPEN supplies static pressure from the nose compartment to the pilot's instruments through the union-type static port and the control valve. The control valve handle, when not in use, is safety wired in the CLOSED position with breakaway safety wire.
      (3) The RH aft static port provides static pressure for the cabin pressurization system. An alternate static port, installed in the nose compartment, acts as a backup for the RH aft port should it become blocked.
      (4) The two shoulder static ports installed forward of the windshield halves supply static pressure to the autopilot air data sensor. For further information on the autopilot static system refer to 22-00-00.
      (5) A static port located at frame 25 is used as the cabin safety valve static source. For further information on the cabin safety valve static source, refer to 21-30-00.



Pitot and Static Systems Schematic
Figure 1 (Sheet 1 of 2)



Pitot and Static Systems Schematic
Figure 1 (Sheet 2 of 2)

PITOT AND STATIC SYSTEM - MAINTENANCE PRACTICES

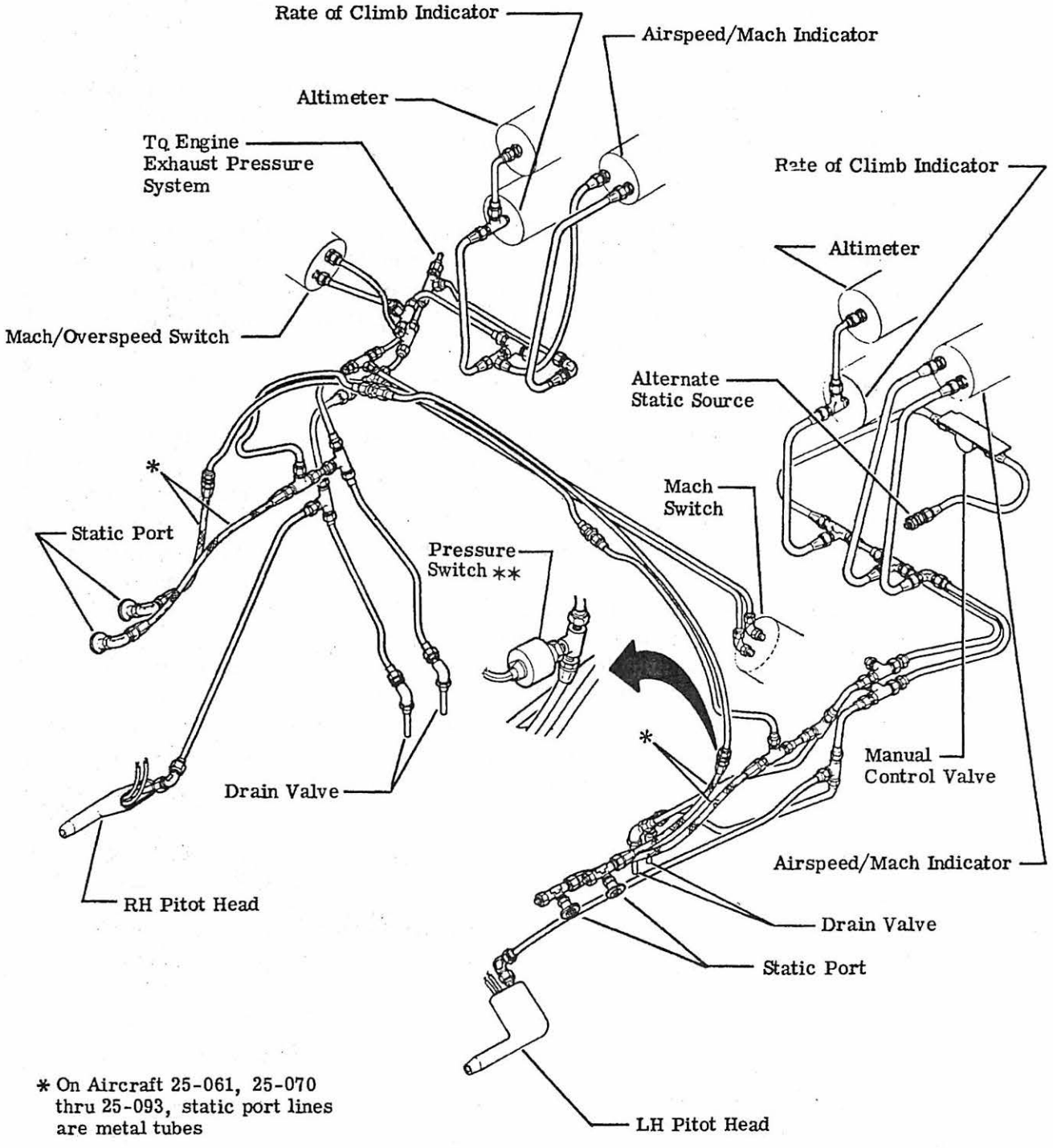
1. General
   A. Maintenance personnel should familiarize themselves with the following general maintenance practices prior to performing maintenance on the system.
   B. Refer to 30-30-00, for Removal and Installation of the static ports.

2. Maintenance Practices
   A. When performing static system leak check, it will be necessary to apply vacuum to both the pitot and static systems simultaneously. This will prevent severe pressure differential which could cause instrument damage. Pressure in the pitot system must always be equal to or slightly greater than that in the static system.
   B. Whenever a pitot or static line is disconnected, all exposed fitttings should be capped or plugged.
   C. All pitot and static line B-nuts incorporate a fitting seal. Each time a line is disconnected, a new fitting seal must be installed.
   D. Pitot system leak check should be performed and all leaks repaired prior to performing static leak check.
   E. Pitot and static system leak checks should be performed at the intervals specified in Chapter 5 as well as anytime an instrument is replaced or a connection is loosened. All maintenance and inspections should be completed prior to performing leak checks.
   F. Use of the system schematic is recommended to prevent application of reverse pressure and to help determine the location of leaks.
   G. Test equipment should be checked for leaks prior to use.
   H. The rate of pressure change or the pressure applied should not exceed the design limits of the instruments.

3. Tools and Equipment

NAME	NUMBER	MANUFACTURER	USE
Pitot and Static System Tester	MB-1	Aircraft Products Co. Bridgeport, Pa.	Test pitot and static system for leaks.
Pressure Seal Tape		3M Co.	To seal pitot and static ports.

4. Inspection/Check
   A. Pitot System Operational Check
      (1) The difference between the pilot's and copilot's airspeed indicator shall not exceed 5 knots while maintaining a constant speed within a range of 80 to 140 knots and not exceed 9 knots while maintaining a constant speed within a range of 150 to 400 knots.



* On Aircraft 25-061, 25-070 thru 25-093, static port lines are metal tubes

** Aircraft 25-206 and Subsequent and Earlier Aircraft equipped with Reduced Approach Speed System.

Pitot Static Plumbing Installation
Figure 201

B. Pitot System Leakage Check

NOTE: All pitot line B-nuts incorporate a fitting seal, P/N AP50A-4 or AP50A-6. Each time a pitot line B-nut is disconnected, a new fitting seal must be installed.

(1) Assure that all pitot lines are secure and the pilot instruments are securely connected.
(2) Attach hose from MB-1 pitot static system test set to left pitot tube making sure drain hole in pitot tube is covered.

CAUTION: APPLY ONLY PRESSURE (NOT VACUUM) TO THE PITOT LINES.

(3) Slowly apply pressure until pilot's airspeed indicator indicates 300 knots. Rate of pressure increase shall not increase the airspeed indicator in excess of 20 knots per second.
(4) Turn off pressure; this will seal the system. The system pressure should not drop in excess of 5 knots in a 5-minute period.
(5) If excessive leakage is indicated, recheck fittings and repeat steps (1) through (4).

CAUTION: DEPRESSURIZATION RATE SHOULD NOT EXCEED 20 KNOTS PER SECOND OR INSTRUMENT DAMAGE COULD RESULT.

(6) Slowly release pressure and remove test unit, checking that pitot tube is clear of obstructions.
(7) Repeat above procedure utilizing right pitot tube and copilot's airspeed indicator.

C. Static System Leakage Check

NOTE: All static line B-nuts incorporate a fitting seal, P/N AP50A-4 or AP50A-6. Each time a static line B-nut is disconnected, a new fitting seal must be installed.

(1) Instrument Static Lines

NOTE: The following procedure is applicable for either the pilot's or copilot's static systems. Check the static systems individually.

(a) Assure all instruments and lines are securely connected and all drain lines are tightly capped. Close the alternate static source manual control valve.

(b) Connect MB-1 pitot static system test set or equivalent to one static port (either right or left) while blocking the remaining static port.

CAUTION: APPLY ONLY SUCTION (VACUUM) TO STATIC SYSTEM AND ASSURE THE TEST SET CROSS-BLEED IS OPEN TO PREVENT DAMAGE TO THE INSTRUMENTS.

NOTE: Steps (c) through (f) consist of a typical vacuum system check. Figures shown will vary with the geographical location where check is to be made. In all cases, the acceptable check consists of evacuation of the static system until a pressure differential is obtained. Without additional pumping for a period of 1 minute, the indicated loss of altitude shall not exceed 2% of the equivalent altitude of the maximum cabin differential pressure or 100 feet, whichever is greater. An altitude to inches of mercury (Hg) conversion table is provided to assist personnel in performing the following check. All altitude readings are taken to the nearest 100 feet.

(c) Determine the local geographical altitude and convert to inches of mercury (Hg).
Example: Wichita, Kansas - Altitude 1332 feet.
Converted to inches of mercury by use of the table in figure 202, 1300 feet = 28.54 (Hg).

NOTE: Cabin differential pressure is 8.9 psi on Aircraft not certified for 51,000 foot operation.
Cabin differential pressure is 9.1 psi on Aircraft certified for 51,000 foot operation.

(d) Convert the cabin differential pressure to inches of mercury by multiplying by 2.04 (the equivalent of 1 psi in inches of mercury). This will equal 18.15 Hg for 8.9 psi differential pressure or 18.56 hg for 9.1 psi differential pressure.

(e) Subtract the results of step (d) from results of (c) and convert to altitude. This is the desired altimeter reading to which the system must be evacuated.
Example: 28.54 Hg minus (-) 18.15 Hg = 10.39.
10.39 converted to altitude = 26,500 feet (this is the required altimeter reading).

(f) Evacuate the system until the altimeter reading determined in step (e) is obtained. Turn off vacuum source, sealing the system. Loss of altitude shall not exceed 2% of the required altimeter

reading in 1 minute.

Example: Required altimeter reading 26,500 feet. 2% of 26,500 feet = 530 feet (maximum drop in 1 minute is 530 feet).

(g) Check the alternate static source by blocking the external static source and opening the manual control valve. Loss of altitude shall not exceed the required reading obtained in step (f).

(h) If acceptable, release vacuum slowly and perform check of remaining static system.

(2) Cabin Safety Valve Static Line

(a) Gain access to the static port behind frame 25 through the tailcone access door.

(b) Connect vacuum side of MB-1 tester to static port.

(c) Remove filter from cabin safety valve and cap fitting.

CAUTION: APPLY VACUUM WITH MB-1 TESTER AT A RATE NOT TO EXCEED 2000 FEET PER MINUTE OR DAMAGE TO THE CABIN SAFETY VALVE DIAPHRAGM COULD RESULT.

(d) Apply a vacuum of 10,000 feet with MB-1 tester. Allow vacuum to stabilize and close valve on tester.

(e) The altimeter should not decrease more than 100 feet per minute.

(f) If acceptable, release vacuum slowly (not to exceed 2000 fpm) and return system to normal.

(3) Pressurization Module Static Line

(a) Connect vacuum side of MB-1 tester to the alternate static source located in the nose compartment.

(b) Block the RH aft static port.

(c) Remove filter from pressurization module assembly and cap fitting.

(d) Set rate selector on the pressurization module assembly to full INC.

(e) Set altitude controller to maximum cabin differential pressure.

(f) Position the Manual Cabin Altitude Control Valve on the instrument panel to the UP position.

CAUTION: APPLY VACUUM WITH MB-1 TESTER AT A RATE NOT TO EXCEED 2000 FEET PER MINUTE OR DAMAGE OF THE RATE CONTROL DIAPHRAGM COULD RESULT.

(g) Apply a vacuum of 10,000 feet with MB-1 tester. Allow vacuum to stabilize and close valve tester.

(h) The altimeter should not decrease more than 500 feet per minute.

(i) If acceptable, release vacuum slowly (not to exceed 2000 fpm) and return system to normal.

STATIC PRESSURE p IN INCHES OF MERCURY FOR VALUES OF PRESSURE ALTITUDE H IN GEOPOTENTIAL FEET

Pressure Altitude, H Geopotential Ft.	0	100	200	300	400	500	600	700	800	900
-1,000	31.01									
-0		30.02	30.13	30.24	30.35	30.46	30.57	30.68	30.79	30.90
0	29.92	29.81	29.70	29.59	29.49	29.38	29.27	29.17	29.06	28.96
1,000	28.85	28.75	28.64	28.54	28.43	28.33	28.23	28.12	28.02	27.92
2,000	27.82	27.71	27.61	27.51	27.41	27.31	27.21	27.11	27.01	26.91
3,000	26.81	26.71	26.61	26.52	26.42	26.32	26.22	26.13	26.03	25.93
4,000	25.84	25.74	25.65	25.55	25.46	25.36	25.27	25.17	25.08	24.98
5,000	24.89	24.80	24.71	24.61	24.52	24.43	24.34	24.25	24.15	24.06
6,000	23.97	23.88	23.79	23.70	23.61	23.52	23.44	23.35	23.26	23.17
7,000	23.08	23.00	22.91	22.82	22.73	22.65	22.56	22.48	22.39	22.31
8,000	22.22	22.14	22.05	21.97	21.88	21.80	21.71	21.63	21.55	21.47
9,000	21.38	21.30	21.22	21.14	21.06	20.97	20.89	20.81	20.73	20.65
10,000	20.57	20.49	20.41	20.33	20.25	20.18	20.10	20.02	19.94	19.86
11,000	19.79	19.71	19.63	19.55	19.48	19.40	19.33	19.25	19.17	19.10
12,000	19.02	18.95	18.87	18.80	18.73	18.65	18.58	18.51	18.43	18.36
13,000	18.29	18.21	18.14	18.07	18.00	17.93	17.86	17.78	17.71	17.64
14,000	17.57	17.50	17.43	17.36	17.29	17.22	17.15	17.09	17.02	16.95
15,000	16.88	16.81	16.75	16.68	16.61	16.54	16.48	16.41	16.34	16.28
16,000	16.21	16.15	16.08	16.01	15.95	15.88	15.82	15.76	15.69	15.63
17,000	15.56	15.50	15.44	15.37	15.31	15.25	15.19	15.12	15.06	15.00
18,000	14.94	14.88	14.81	14.75	14.69	14.63	14.57	14.51	14.45	14.39
19,000	14.33	14.27	14.21	14.15	14.09	14.04	13.98	13.92	13.86	13.80
20,000	13.75	13.69	13.63	13.57	13.52	13.46	13.40	13.35	13.29	13.23
21,000	13.18	13.12	13.07	13.01	12.96	12.90	12.85	12.79	12.74	12.69
22,000	12.63	12.58	12.52	12.47	12.42	12.36	12.31	12.26	12.21	12.15
23,000	12.10	12.05	12.00	11.95	11.90	11.84	11.79	11.74	11.69	11.64
24,000	11.59	11.54	11.49	11.44	11.39	11.34	11.29	11.24	11.20	11.15
25,000	11.10	11.05	11.00	10.95	10.91	10.86	10.81	10.76	10.72	10.67
26,000	10.62	10.58	10.53	10.48	10.44	10.39	10.34	10.30	10.25	10.21
27,000	10.16	10.12	10.07	10.03	9.98	9.94	9.90	9.85	9.81	9.76
28,000	9.72	9.68	9.63	9.59	9.55	9.50	9.46	9.42	9.38	9.33
29,000	9.29	9.25	9.21	9.17	9.13	9.08	9.04	9.00	8.96	8.92
30,000	8.88	8.84	8.80	8.76	8.72	8.68	8.64	8.60	8.56	8.52
31,000	8.48	8.44	8.41	8.37	8.33	8.29	8.25	8.21	8.18	8.14
32,000	8.10	8.06	8.03	7.99	7.95	7.91	7.88	7.84	7.80	7.77
33,000	7.73	7.70	7.66	7.62	7.59	7.55	7.52	7.48	7.45	7.41
34,000	7.38	7.34	7.31	7.27	7.24	7.20	7.17	7.14	7.10	7.07
35,000	7.04	7.00	6.97	6.94	6.90	6.87	6.84	6.80	6.77	6.74
36,000	6.71	6.67	6.64		6.58		6.52		6.45	
37,000	6.39		6.33		6.27		6.21		6.15	
38,000	6.09		6.03		5.98		5.92		5.86	
39,000	5.81		5.75		5.70		5.64		5.59	
40,000	5.53		5.48		5.43		5.38		5.32	
41,000	5.27		5.22		5.17		5.12		5.07	
42,000	5.03		4.98		4.93		4.88		4.84	
43,000	4.79		4.74		4.70		4.65		4.61	
44,000	4.56		4.52		4.48		4.43		4.39	
45,000	4.35		4.31		4.27		4.23		4.19	
46,000	4.15		4.11		4.07		4.03		3.99	
47,000	3.95		3.91		3.88		3.84		3.80	
48,000	3.77		3.73		3.69		3.66		3.62	
49,000	3.59		3.55		3.52		3.49		3.45	
50,000	3.42		3.39		3.35		3.32		3.29	
51,000	3.26		3.23		3.20		3.17		3.14	

Conversion Table - Altitude to Inches of Mercury
Figure 202

PITOT TUBE - MAINTENANCE PRACTICES

1. General

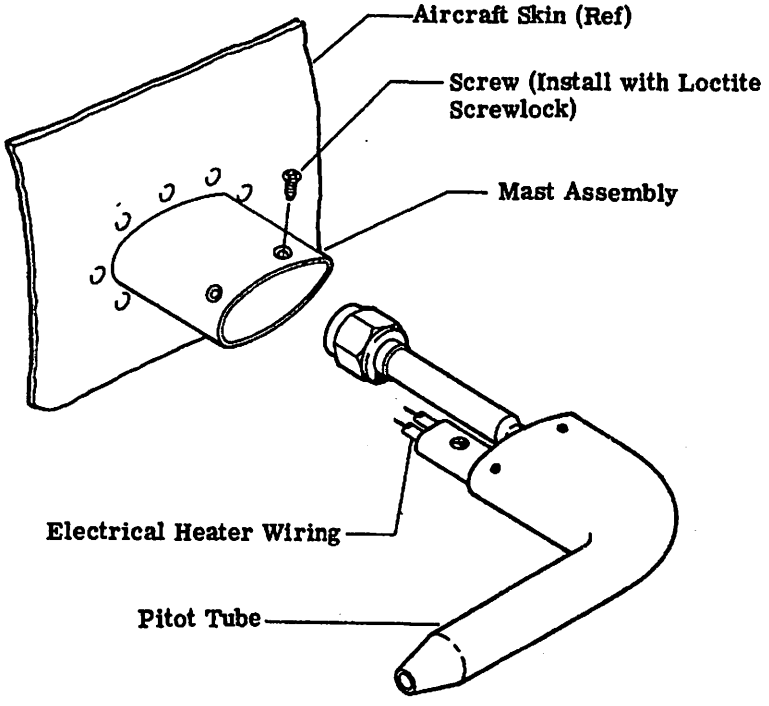
A. The pitot tubes are located on each side of the nose compartment at approximately F. S. 150.93. Each pitot tube is equipped with two electrical heating elements to prevent moisture from freezing on the mast and/or obstructing the tubes. The tube heaters are powered by 28 vdc and controlled by the Pitot Heat Switches.

2. Removal/Installation

NOTE: Removal and installation procedure for either pitot tube is identical.

A. Remove Pitot Tube (See figure 201)
   (1) Remove nose compartment access doors.
   (2) Disconnect pitot line from pitot tube. Cap exposed line.
   (3) Disconnect electrical wiring from pitot tube.
   (4) Remove attaching parts and pitot tube from mast.

B. Install Pitot Tube (See figure 201)
   (1) Install pitot tube in mast. Apply Loctite Screwlock to screws and secure pitot tube to mast.
   (2) Remove cap from pitot line and connect line to pitot tube.
   (3) Connect electrical wiring to pitot tube.

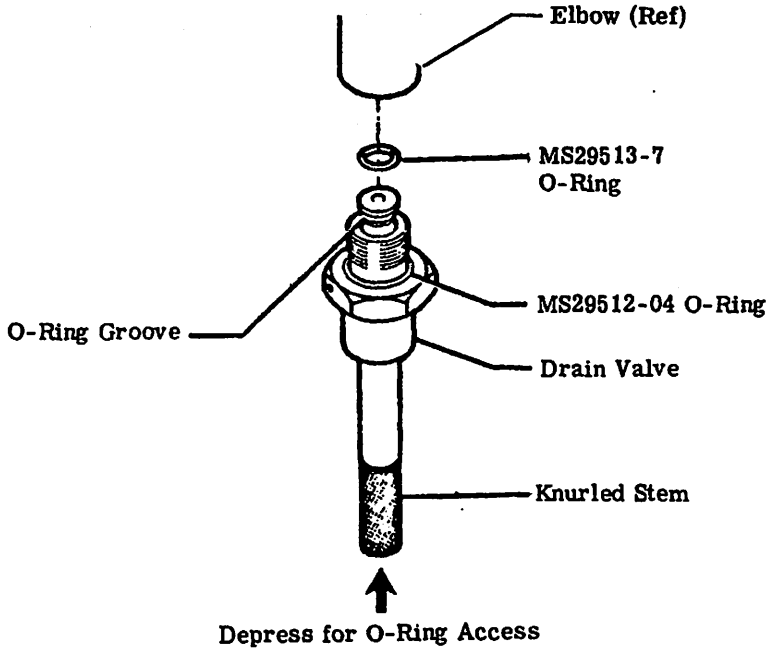


Pitot Tube Installation
Figure 201

DRAIN VALVE - MAINTENANCE PRACTICES

1. General
   A. Each pitot system incorporates a drain valve. The drain valves are located in the nose compartment on each side of the nose wheel well.
   B. If excessive leakage is evident in the pitot system the drain valve O-ring seals should be checked.
   C. The valves are sping loaded closed and sealed with an internal O-ring. The valves have a knurled stem which can be depressed with the fingers. The valve may be unscrewed from the elbow.

2. Approved Repair
   A. Drain Valve O-Ring Replacement (See figure 201)
      (1) Remove equipment as required to gain access to drain valve installation.
      (2) Loosen and remove drain valve from the elbow.
      (3) Depress the knurled stem on the drain valve to expose the O-ring.
      (4) Using a suitable tool, remove old O-ring.
      (5) Inspect valve O-ring groove and seat for scratches, burrs or dirt.
      (6) Replace damaged O-ring or drain valve.
      (7) Install drain valve in elbow and tighten.
      (8) Install previously removed equipment.

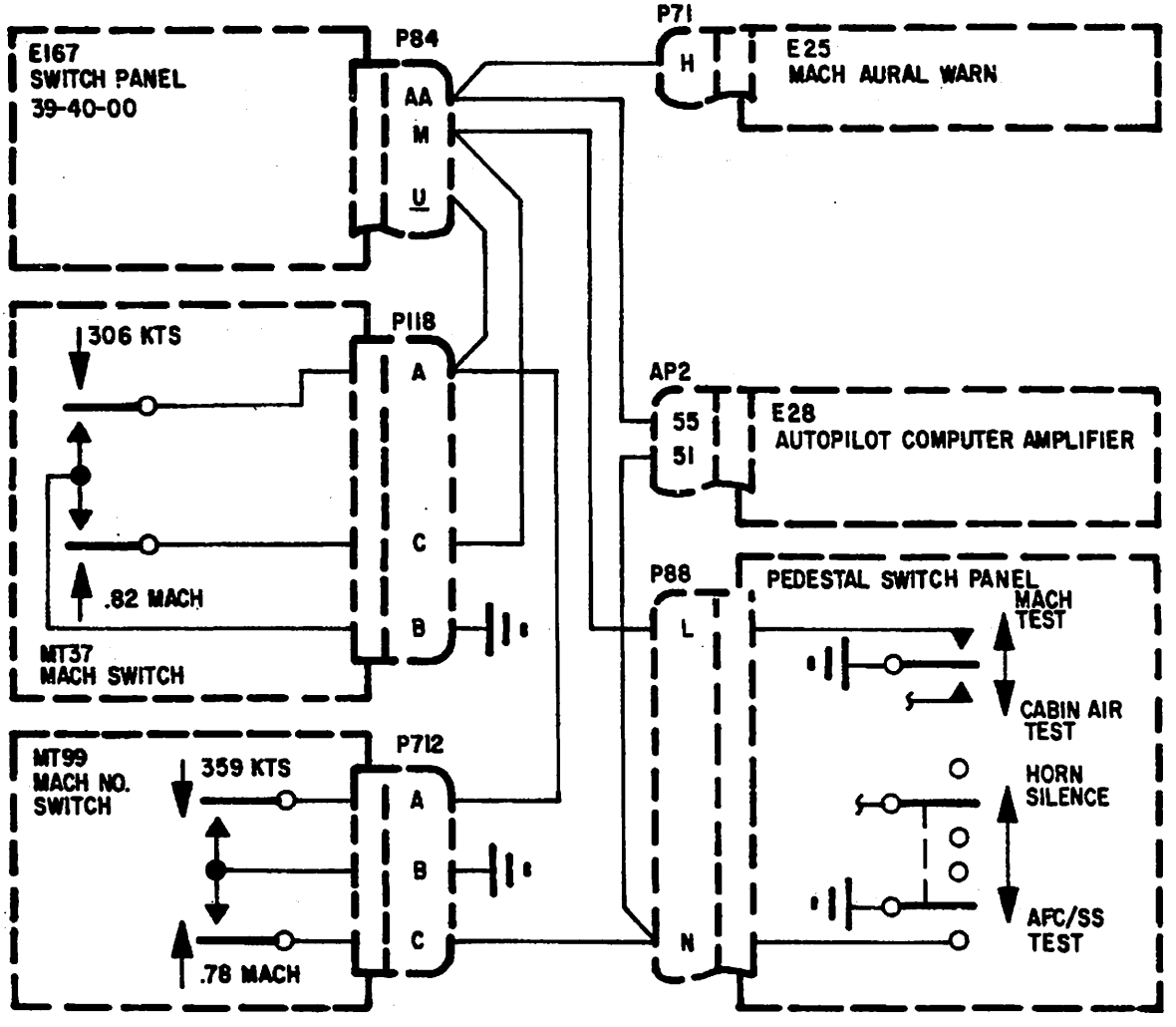


Drain Valve O-Ring Replacement
Figure 201

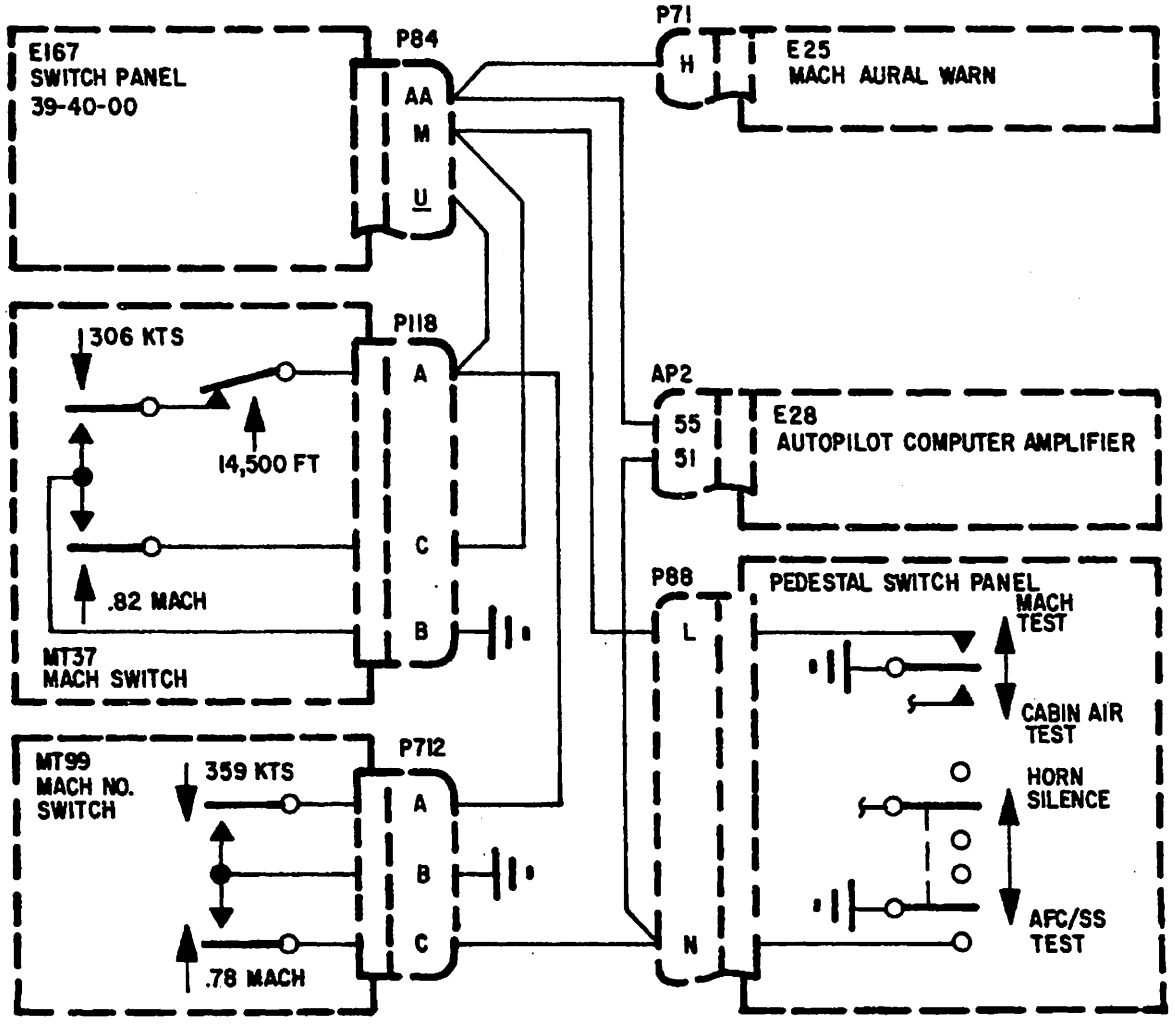
MACH/OVERSPEED WARNING - DESCRIPTION AND OPERATION

1. General
   A. The mach/overspeed warning system provides the crew with an aural warning when:
      (1) The aircraft speed exceeds 306 (±3) KIAS below 30,000 on Aircraft 25-061, -070 thru -206 not equipped with reduced approach speed system or 306 (±3) KIAS below 14,500 (±500) feet on Aircraft 25-206 and Subsequent and earlier aircraft equipped with Reduced Approach Speed System.
      (2) The aircraft speed exceeds 359 (±4) KIAS between 14,500 (±500) and 21,500 feet (AFC/SS inoperative) or 24,500 feet (AFC/SS operative) on Aircraft 25-206 and Subsequent and earlier aircraft equipped with Reduced Approach Speed System.
      (3) The aircraft speed exceeds 0.82 (±.01) Mach above 32,000 feet with AFC/SS operative on Aircraft 25-061, -070 thru -205 not equipped with Reduced Approach Speed System.
      (4) The aircraft speed exceeds 0.82 (±.01) Mach above 24,500 feet with AFC/SS operative on Aircraft 25-206 and Subsequent and earlier aircraft equipped with Reduced Approach Speed System.
      (5) The aircraft speed exceeds 0.78 (±.01) Mach above 30,000 feet with AFC/SS inoperative on Aircraft 25-061, -070 thru -205 not equipped with Reduced Approach Speed System.
      (6) The aircraft speed exceeds 0.78 (±.01) Mach above 21,500 feet with AFC/SS inoperative on Aircraft 25-206 and Subsequent and earlier aircraft equipped with Reduced Approach Speed System.
   B. The puller control system commands a nose-up attitude as corrective action for the mach function.
   C. The malfunction aural warning control box is installed on the lower side of the cabin floorboards between frames 14 and 15 and RBL 6.14 and 18.32.

2. Description
   A. The system consists of a mach/overspeed switch, a pitot and static source, a stick puller adjustment potentiometer and the aural warning horn.
   B. Autopilot pitch servo is used for stick puller actuation. A test switch located on the pedestal is used to check system operation. The system is powered by 28 vdc through the LH stall warning switch.



Mach/Overspeed Warning System Electrical Control Schematic
Figure 1 (Sheet 1 of 2)



Mach/Overspeed Warning System Electrical Control Schematic
Figure 1 (Sheet 2 of 2)

MACH/OVERSPEED WARNING - MAINTENANCE PRACTICES

1. General
   A. Maintenance procedures for the Mach/Overspeed warning system consist of a stick puller functional check, a functional check of the mach switch and replacement of defective components.
   B. During normal aircraft flight, the Mach/Overspeed Switch is seldom actuated; therefore, it is recommended that the Mach/Overspeed Switch be functionally checked in accordance with current inspection requirements. (Refer to 5-00-00)
   C. Refer to applicable removal and installation procedures of the individual components.

2. Tools and Equipment

NAME	NUMBER	MANUFACTURER	USE
Spring Scale	CATL80D	Chatillion Co. New York	To measure stick force.
Pitot & Static Tester	MB-1	Aircraft Products Co., Bridgeport, Pa.	To check Mach/Overspeed Switch.

3. Inspection/Check
   A. Stick Puller Functional Check (See figure 201)

      NOTE: An adjustable potentiometer, located on the autopilot computer-amplifier rack under the pilot's seat, provides a means of adjusting the stick puller force. Clockwise rotation of the potentiometer screw will increase the stick puller force; counterclockwise screw rotation will decrease stick puller force.

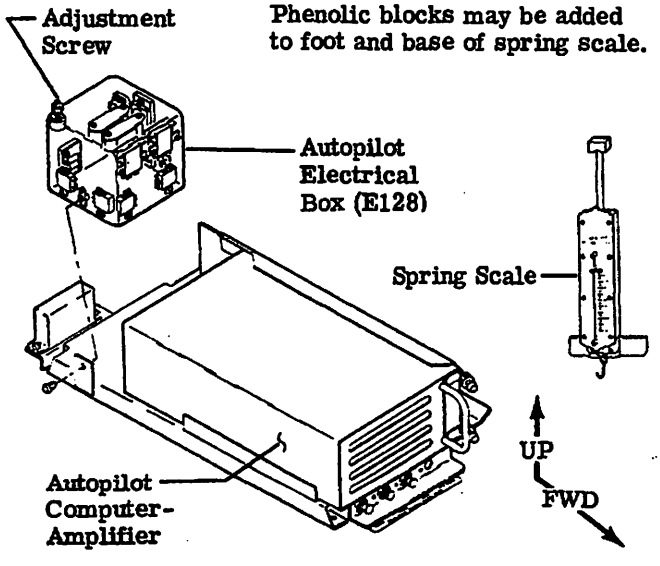
      (1) Set Battery Switches and Left Stall Warning switch to ON.
      (2) Set Mach Test switch to MACH TEST; the aural warning unit should sound and the stick puller will actuate, causing the control columns to move aft from neutral.

         NOTE: Use a push-type spring scale of 80 pounds capacity to measure stick puller force. Use a Gage F, Model No. CATL80D Scale (manufactured by Chatillion Co, New York, N. Y.) or equivalent.

      (3) Hold foot of spring scale firmly against center of one control wheel just below the wheel hub.

CAUTION: DO NOT HOLD SPRING SCALE ON CONTROL COLUMN BELOW THIS POINT AS AN EXCESSIVE AMOUNT OF PULLER FORCE WILL RESULT.

(4) Loosen retaining nut on potentiometer screw and slowly adjust screw until a force of 18 (±2) pounds is indicated on spring scale. Tighten retaining nut on potentiometer screw.
(5) Push control wheel forward with spring scale to check override.
(6) Recheck stick puller force for 18 (±2) pounds.
(7) Set all switches to off.



Stick Puller Adjustment Potentiometer
Figure 201

B. Mach/Overspeed Switch Functional Check (Aircraft 25-061, 25-070 thru 25-205 not equipped with Reduced Approach Speed System)

(1) Attach hose from MB-1 pitot port to the RH pitot head. Remove cap from RH static line forward of the instrument panel and attach hose from MB-1 static port to instrument static line. Assure that static ports are blocked with tape and all drain valves are closed.

(2) Set Battery Switch(es) and Left Stall Warning Switch to ON.

(3) Close MB-1 source valves, vent valves and open the crossbleed valve.

CAUTION: DO NOT EXCEED 5000 FEET PER MINUTE RATE OF CLIMB WHILE APPLYING VACUUM TO THE PITOT AND STATIC SYSTEM. EXCEEDING 5000 FEET PER MINUTE RATE OF CLIMB MAY CAUSE DAMAGE TO THE INSTRUMENT.

(4) Using the MB-1 vacuum pump and opening the vacuum source valve, apply vacuum to both the pitot and static systems until the copilot's altimeter indicates 10,000 feet corrected altitude (refer to instrument error correction card). Close source valve and crossbleed valve.

CAUTION: DO NOT EXCEED 20 KNOTS PER SECOND WHEN VENTING ATMOSPHERIC PRESSURE INTO PITOT SYSTEM. EXCEEDING 20 KNOTS PER SECOND MAY CAUSE DAMAGE TO THE INSTRUMENT.

(5) With crossbleed valve closed, slowly open pitot vent valve and vent atmospheric pressure into the pitot system. This will cause the copilot's airspeed indicator to increase. When aural warning sounds, immediately close pitot vent valve and record airspeed at which aural warning sounds. Aural warning will sound at 305 to 311 knots at 10,000 feet.

(6) Slowly open MB-1 crossbleed valve to return the airspeed indicator to zero.

(7) With the crossbleed valve open and using the MB-1 vacuum pump and opening vacuum source valve, apply vacuum to both the pitot and static systems until copilot's altimeter indicates 41,000 feet corrected altitude (refer to instrument error correction card). Close vacuum source valve and crossbleed valve.

(8) With crossbleed valve closed, slowly open pitot vent valve and vent atmospheric pressure into pitot system. This will cause the copilot's airspeed indicator to increase. When aural warning sounds and puller activates, immediately close pitot vent valve and record airspeed at which aural warning sounds. Aural warn-

ing will sound at 0.82 (±.01) 239 to 246 knots at 41,000 feet.

(9) Slowly open crossbleed valve to return the airspeed indicator to zero. With the crossbleed valve open, slowly open the static vent valve to return the altimeter to field elevation.

(10) Disconnect MB-1 tester from the static and pitot systems. Set Battery Switch(es) and Left Stall Warning Switch to OFF. Install instrument line plug and remove tape from static ports and drains.

C. Mach/Overspeed Switch Functional Check (Aircraft 25-206 and Subsequent and Earlier Aircraft equipped with Reduced Approach Speed System).

NOTE: All altimeter and airspeed readings for this functional test are taken from the copilot's instruments.

(1) Attach pitot hose from pitot-static tester to the RH pitot head. Remove cap from RH static line forward of instrument panel and attach static hose to instrument static line. Assure that static ports are blocked with tape and all drain valves are closed. On Aircraft 25-270, 25-272 and Subsequent, attach a second static hose to the shoulder static system. This will prevent damage to the Air Data Sensor.

NOTE: A tee and cap assembly is installed in the shoulder port static line just forward of frame 3 (LH side). Connect second static hose to tee and block shoulder static ports with tape. If tee is used for a static source for avionics equipment, install a tee in place of the union just forward of frame 2.

(2) Assure that the Autopilot System is off.

(3) Set Battery switch(es) and Left Stall Warning switch to ON.

(4) Close pitot-static tester source valves, vent valves and open the crossbleed valve.

CAUTION: DO NOT EXCEED 5000 FEET PER MINUTE RATE OF CLIMB WHILE APPLYING VACUUM TO THE PITOT AND STATIC SYSTEM. EXCEEDING 5000 FEET PER MINUTE RATE OF CLIMB MAY CAUSE DAMAGE TO THE INSTRUMENT.

(5) Using the pitot-static tester vacuum pump and opening the vacuum source valve, apply vacuum to both the pitot and static systems until the copilot's altimeter indicates 12,500 feet corrected altitude (refer to instrument error correction card). Close source valve and crossbleed valve.

CAUTION: DO NOT EXCEED 20 KNOTS PER SECOND WHEN VENTING ATMOSPHERIC PRESSURE INTO PITOT SYSTEM. EXCEEDING 20 KNOTS PER SECOND MAY CAUSE DAMAGE TO THE INSTRUMENT.

(6) With crossbleed valve closed, slowly open pitot vent valve and vent atmospheric pressure into the pitot system. This will cause the co-pilot's airspeed indicator to increase. When aural warning sounds, immediately close pitot vent valve and record airspeed at which aural warning sounds. Aural warning will sound at 303 to 309 knots at 12,500 feet.

(7) Slowly open pitot-static tester crossbleed valve to return the airspeed indicator to zero.

(8) With the crossbleed valve open and using the pitot-static tester vacuum source pump and opening vacuum source valve, apply vacuum to both pitot and static systems until copilot's altimeter indicates 16,500 feet corrected altitude (refer to instrument error correction card). Close vacuum source valve and crossbleed valve.

(9) With the crossbleed valve closed, slowly open pitot vent valve and vent atmospheric pressure into pitot system. This will cause the copilot's airspeed indicator to increase. When aural warning sounds, immediately close pitot vent valve and record airspeed at which the aural warning sounds. The aural warning will sound at 359 (±4) knots indicated airspeed at 16,500 feet.

(10) Slowly open the crossbleed valve until the aural warning stops. Close the valve when airspeed indicator reads 340 knots.

(11) Slowly vent the static pressure to lower the indicated altitude. The aural overspeed warning shall again sound at a minimum of 12,200 feet. Close the pitot vent valve.

NOTE: The mach switch (MT37) must reset within 1800 feet of the ascending actuation point (14,500 ±500 feet). The 12,200 feet altitude is the minimum allowable reset altitude.

(12) Slowly open pitot-static tester crossbleed valve to return the airspeed indicator to zero.

(13) With the crossbleed valve open and using the pitot-static tester vacuum pump and opening vacuum source valve, apply vacuum to both the pitot and static systems until copilot's altimeter indicates 41,000 feet corrected altitude (refer to instrument error correction card). Close vacuum source valve and crossbleed valve.

(14) With crossbleed valve closed, slowly open pitot vent valve and vent atmospheric pressure into pitot system. This will cause the copilot's airspeed indicator to increase. When aural warning sounds, immediately close pitot vent valve and record airspeed at which aural warning sounds. Aural warning will sound at 0.78 (±.01) mach (221 to 238 knots) at 41,000 feet.

(15) Engage Autopilot System. Aural warning horn will stop.

(16) Open pitot vent valve and increase airspeed until aural warning sounds and puller activates. Immediately close pitot vent valve and record airspeed. Airspeed should be 0.82 (±.01) Mach (234 to 251 knots) at 41,000 feet.

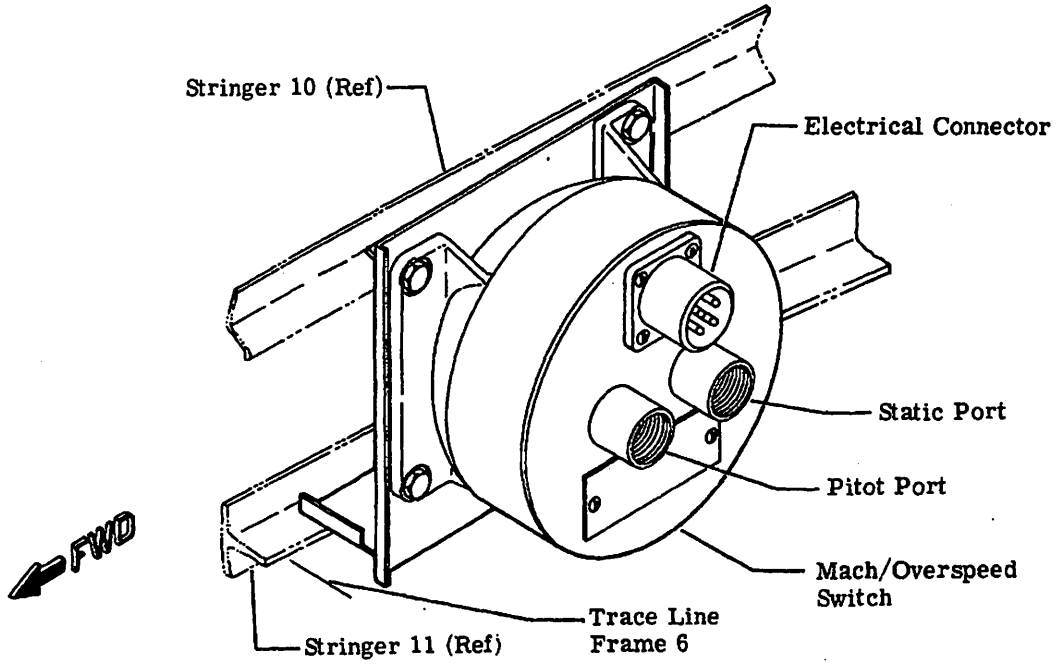
(17) Slowly open crossbleed valve to return the airspeed indicator to zero. With the crossbleed valve open, slowly open the static vent valve to return the altimeter to field elevation.

(18) Disconnect pitot-static tester from the static and pitot systems. Set Autopilot system to off, and Battery switch(es) and Left Stall Warning switch to OFF. Install instrument line plug, cap assembly on shoulder static line tee (if applicable) and remove tape from static ports and drains.

MACH/OVERSPEED SWITCH - MAINTENANCE PRACTICES

1. General
   A. Maintenance practices consist of replacement of defective component.
   B. The mach switch is located on the RH side of the cockpit forward of the instrument panel.

2. Removal/Installation
   A. Remove Mach Switch (See figure 201)
      (1) Assure that Battery Switch(es) and Stall Warning Switches are OFF.
      (2) Lower copilot's instrument panel.
      (3) Disconnect electrical plug from mach switch.
      (4) Disconnect pitot and static line from mach meter. Cap all exposed fittings.
      (5) Remove attaching parts and mach switch from aircraft.
   B. Install Mach Switch (See figure 201)
      (1) Install mach switch and secure with attaching parts.
      (2) Remove caps and connect pitot and static lines to mach switch.
      (3) Connect electrical plug to mach switch.
      (4) Raise and secure copilot's instrument panel.
      (5) Perform pitot and static system leakage check. Refer to 34-11-00.



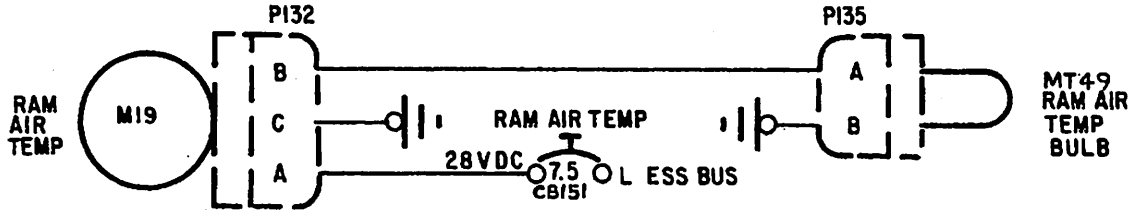
Mach/Overspeed Switch Installation
Figure 201

RAM AIR TEMPERATURE SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The ram air temperature system consists of a temperature indicator, a temperature bulb (resistance type) and a 7.5 ampere system circuit breaker.

2. Description
   A. The temperature indicator is located in the center instrument panel. The indicator is lighted by 5-volt lighting, provided by the pilot's light dimmer assembly.
   B. The temperature bulb (resistance type) is mounted in the aft portion of the dorsal air inlet at approximately F.S. 524.64. The sensing element extends into the air inlet to monitor the incoming air temperature.

3. Operation
   A. The incoming air temperature changes the resistance of the bulb. The changes in resistance are monitored by the temperature indicator and provide the crew with a visual indication of the existing outside air temperature. The indicator is calibrated in degrees centigrade.



Ram Air Temperature Electrical Control Schematic
Figure 1

RAM AIR TEMPERATURE INDICATOR - MAINTENANCE PRACTICES

1. General
   A. The temperature indicator is located in the center instrument panel.

2. Removal/Installation
   A. Remove Temperature Indicator
      (1) Assure that Battery and Stall Warning Switches are OFF.
      (2) Remove attaching parts and panel overlay.
      (3) Loosen instrument clamp screws and remove instrument sufficiently to gain access to the electrical plug.
      (4) Disconnect electrical plug from indicator.
   B. Install Temperature Indicator
      (1) Connect electrical plug to indicator.
      (2) Position indicator in panel and tighten instrument clamp screw.
      (3) Install panel overlay and secure with attaching parts.

RAM AIR TEMPERATURE BULB - MAINTENANCE PRACTICES

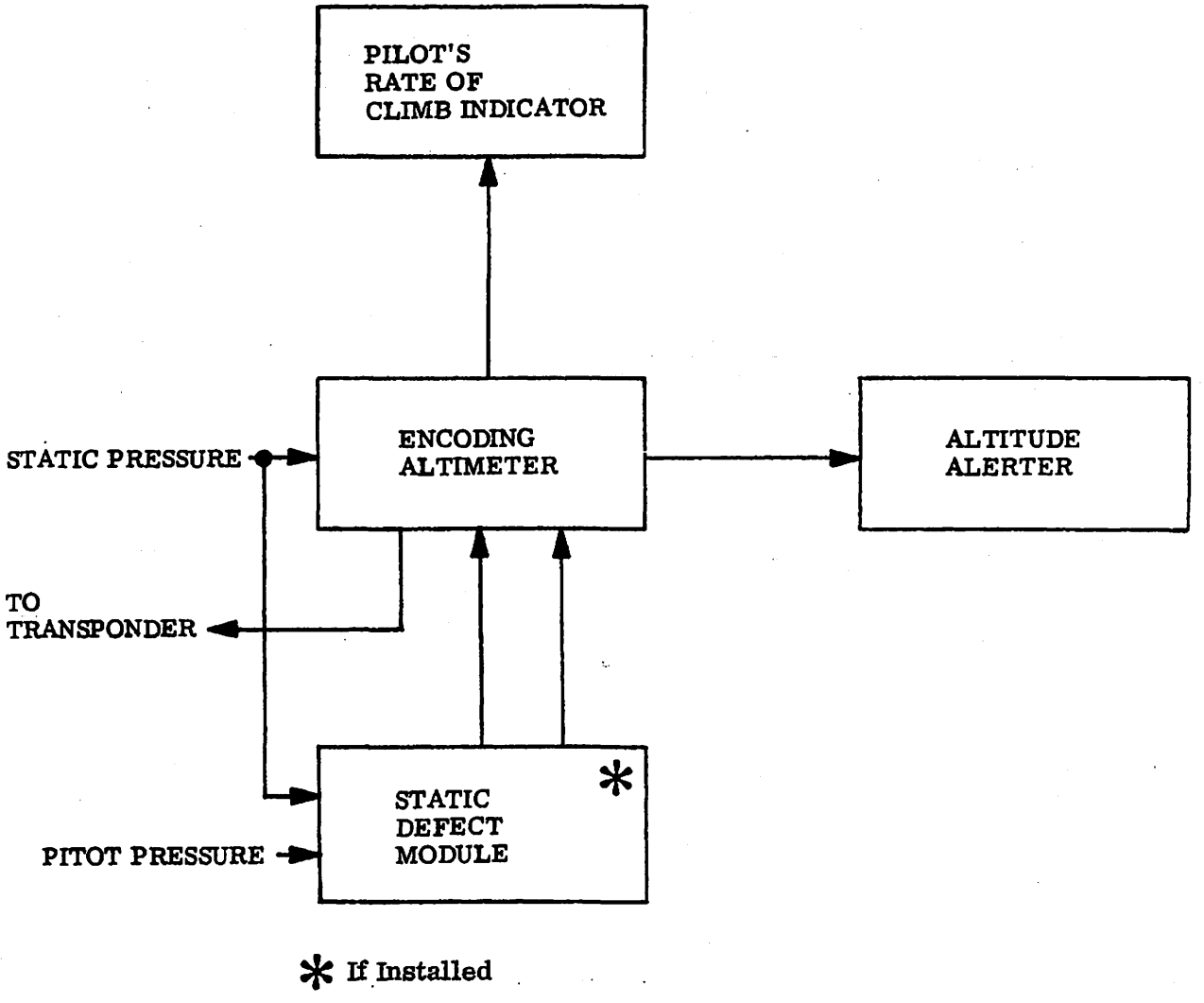
1. General
   A. The ram air temperature bulb is located in the aft portion of the dorsal air inlet. Access to the temperature bulb is gained through the tailcone.

2. Removal/Installation
   A. Remove Temperature Bulb
      (1) Lower tailcone access door.
      (2) Disconnect electrical plug from temperature bulb.
      (3) Loosen and remove temperature bulb.
   B. Install Temperature Bulb
      (1) Install temperature bulb.
      (2) Connect electrical plug to temperature bulb.
      (3) Raise tailcone access door and secure.

ENCODING ALTIMETER - DESCRIPTION AND OPERATION

1. General
   A. The encoding altimeter system is installed for the pilot. The system consists of an encoding altimeter located on the pilot's instrument panel, an altitude alerter on the center instrument panel and a Static Defect Correction (SDC) module (if installed).

2. Description
   A. The basic mechanism of the encoding altimeter is a servo driven counter-pointer display which follows the synchro input from the SDC module when in the normal mode or the signal from its own sensitive diaphragm when in the standby mode. The pilot uses and sets the encoding altimeter in exactly the same way as a standard altimeter. Readout is identical with the familiar counter-drum-pointer presentation. The pointer makes one revolution per one thousand feet. Graduations are at twenty-foot increments. The counter reads altitude in thousands and hundreds of feet.
   B. The altitude alerter is a direct reading type, having a five-digit display. A three digit counter displays thousands and hundreds of feet. Fixed zeros in the tens and units places present the proper number of digits for the preselected aircraft altitude. The unit is self contained in a metal case. As the aircraft approaches the outer limit of a preset flight level, the altitude alerter lights and audio tone (momentarily) are activated. The light remains on until the aircraft crosses the inner level. Should the aircraft fly through or deviate from the preset altitude, visual and aural tones are activated at the inner level. The visual indicator will remain on until the aircraft returns to ±300 feet of preset altitudes or the pilot selects a new altitude.
   C. The SDC module (if installed) measures pitot and static pressures and provides static source error correction for the encoding altimeter. Each module is individually calibrated for the aircraft.

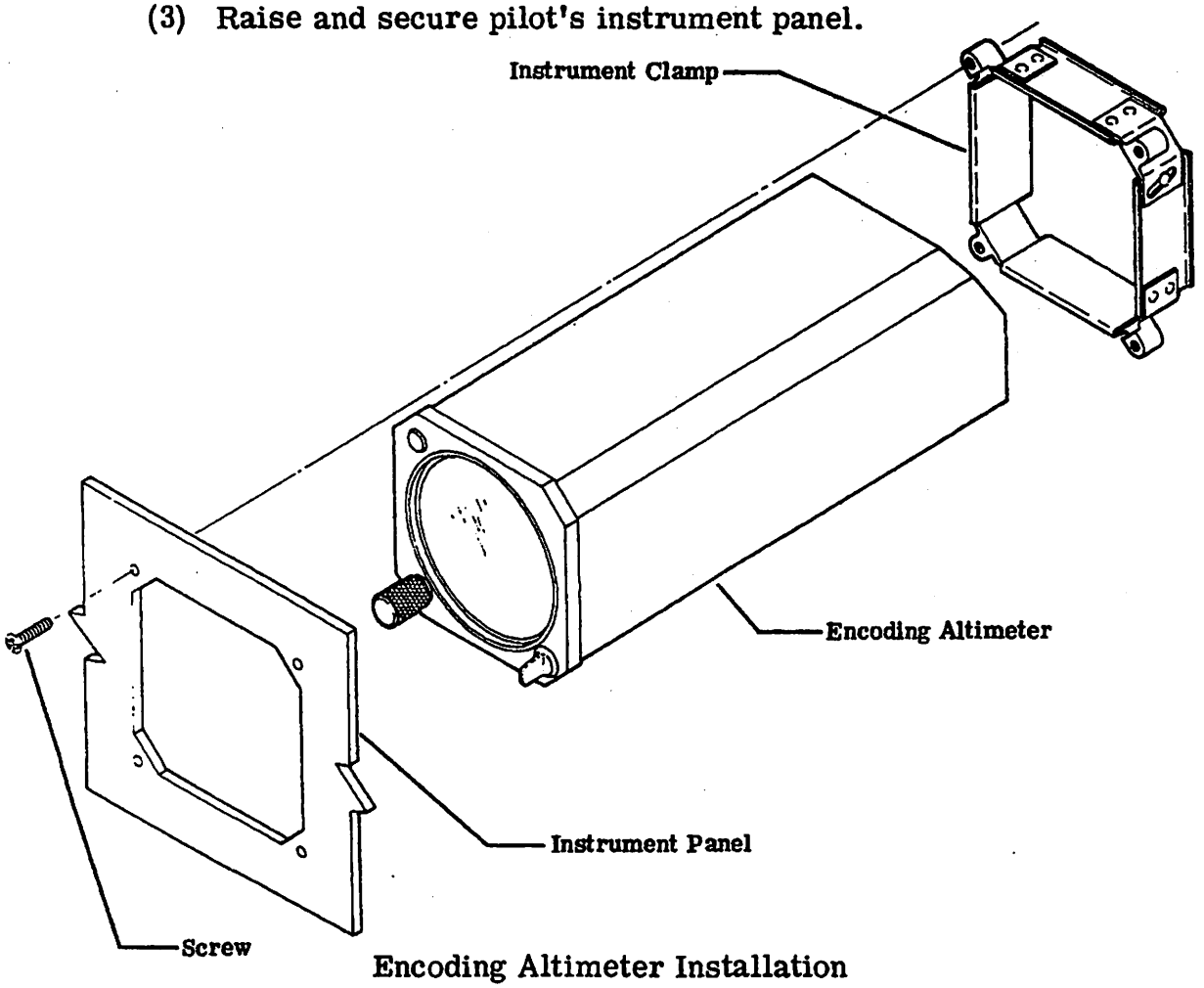


Encoding Altimeter Block Diagram
Figure 1

ENCODING ALTIMETER - MAINTENANCE PRACTICES

1. General
   A. The encoding altimeter is located on the pilot's instrument panel.

2. Removal/Installation
   A. Remove Encoding Altimeter (See figure 201)
      (1) Assure that Battery and Stall Warning Switches are OFF.
      (2) Lower pilot's instrument panel.
      (3) Disconnect static line from altimeter. Cap all exposed fittings.
      (4) Disconnect electrical plug from altimeter. Cap all exposed fittings.
      (5) Loosen altimeter clamp screws and remove altimeter from instrument panel.
   B. Install Encoding Altimeter
      (1) Install altimeter and secure clamp.
      (2) Connect electrical plug and static source to altimeter.
      (3) Raise and secure pilot's instrument panel.

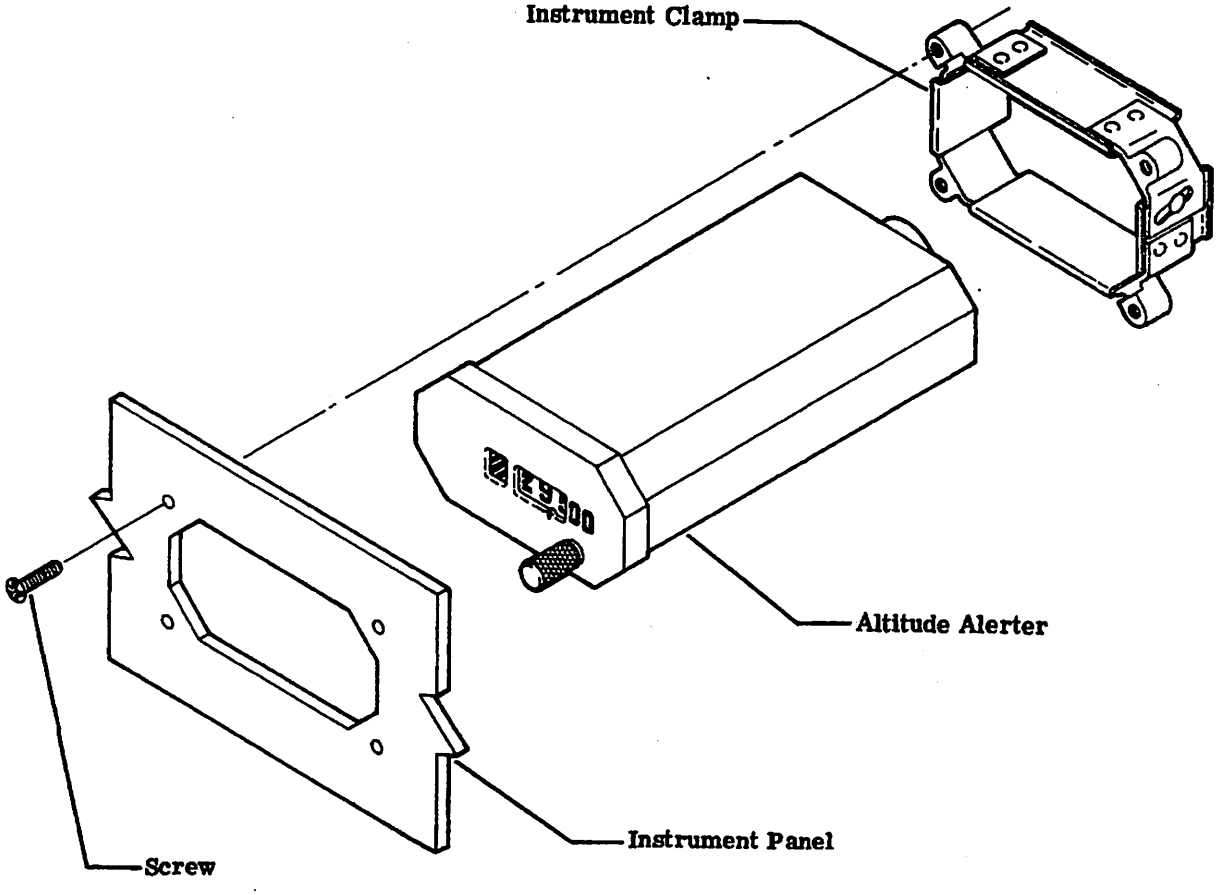


Encoding Altimeter Installation
Figure 201

ALTITUDE ALERTER - MAINTENANCE PRACTICES

1. General
   A. The altitude alerter is installed in the center instrument panel.

2. Removal/Installation
   A. Remove Altitude Alerter (See figure 201)
      (1) Assure that Battery and Stall Warning Switches are OFF.
      (2) Loosen screws and remove overlay from center instrument panel.
      (3) Loosen clamp screws and remove altitude alerter from instrument panel sufficiently to gain access to electrical plug.
      (4) Disconnect electrical plug from altitude alerter.
   B. Install Altitude Alerter (See figure 201)
      (1) Connect electrical plug to altitude alerter.
      (2) Install altitude alerter and secure clamp screws.
      (3) Install overlay on panel and secure with screws.

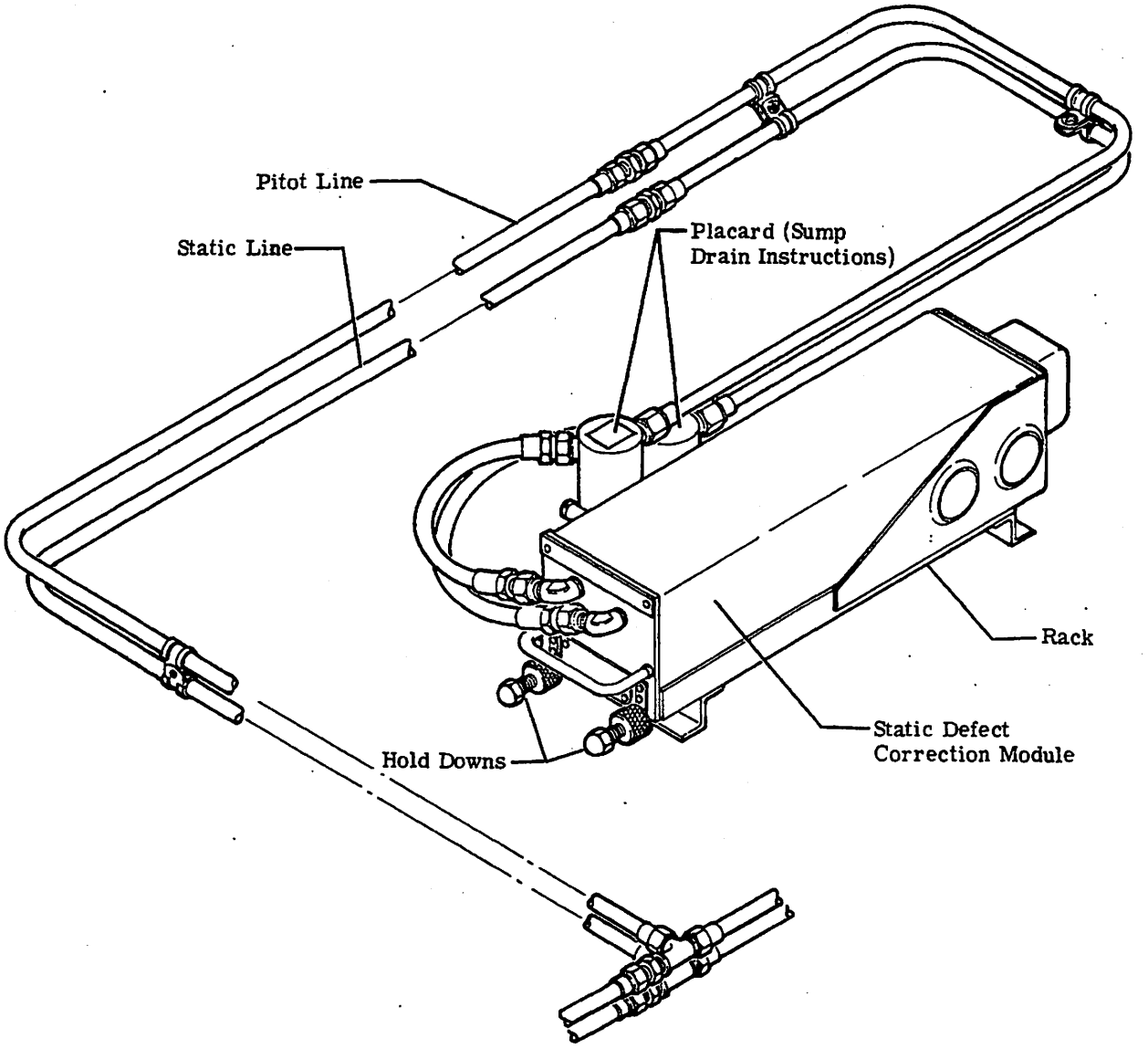


Altitude Alerter Installation
Figure 201

STATIC DEFECT CORRECTION MODULE - MAINTENANCE PRACTICES

1. General
   A. The Static Defect Correction (SDC) module is a rack mounted instrument, located on the LH side of the nose compartment. On some Aircraft the SDC module may be installed beneath the copilot's seat.
   B. The SDC module incorporates a pitot and static line connection which connect to the normal pitot and static systems. The SDC pitot and static lines are connected to normal pitot and static sources adjacent to the LH side pitot and static drain valves.

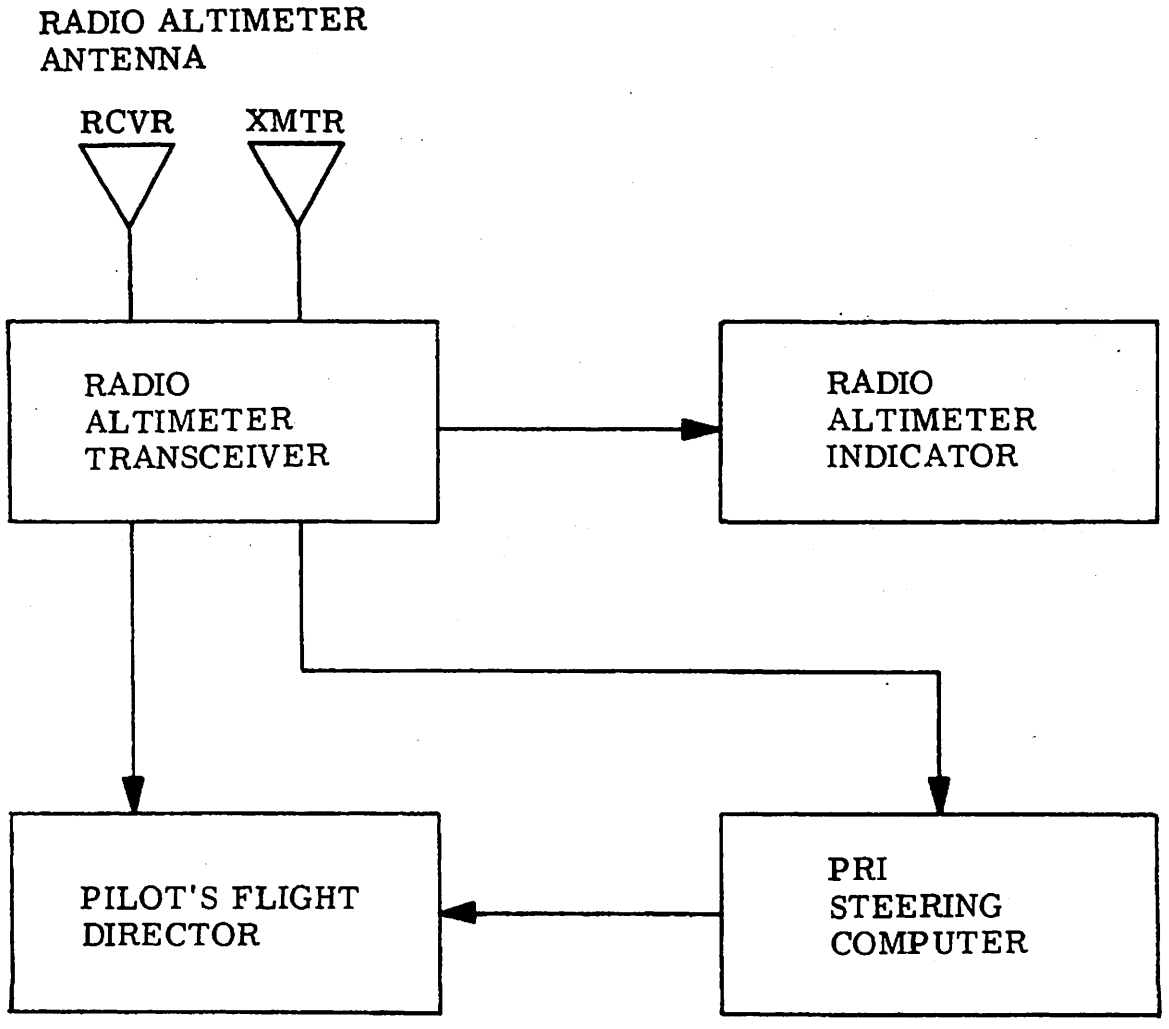
2. Removal/Installation
   A. Remove SDC module (See figure 201)
      (1) Remove nose compartment access doors or on Aircraft with SDC module beneath copilot's seat, remove equipment as necessary to gain access to SDC module.
      (2) Disconnect pitot and static lines from module. Tag lines and cap all exposed fittings.
      (3) Loosen rack hold downs and slide module from rack.
   B. Install SDC Module (See figure 201)
      (1) Slide module into rack and secure with hold downs.
      (2) Remove caps and connect pitot and static lines.
      (3) Install nose compartment access doors.



SDC Module Installation
Figure 201

RADIO ALTIMETER - DESCRIPTION AND OPERATION

1. General
   A. The radio altimeter system consists of the indicator, transceiver and dual antennas.
   B. The system provides the pilot with a precise indication of the aircraft's altitude from 0 to 2500 feet. In addition, the system provides continuous altitude output signals to the pilot's flight director indicator.



Radio Altimeter Block Diagram
Figure 1

RADIO ALTIMETER TRANSCEIVER - MAINTENANCE PRACTICES

1. General
   A. The transceiver is located on the baggage compartment floor or on the RH side of the nose compartment.

2. Removal/Installation
   A. Remove Transceiver
      (1) Disconnect antenna leads and electrical plug from transceiver.
      (2) Remove attaching parts and transceiver from aircraft.
   B. Install Transceiver
      (1) Install transceiver and secure with attaching parts.
      (2) Connect antenna leads and electrical plugs.

RADIO ALTIMETER INDICATOR - MAINTENANCE PRACTICES

1. General
   A. The indicator is installed in the pilot's instrument panel. The indicator is secured to the panel by an instrument clamp.
   B. Maintenance practices consist of replacement of defective indicator.

2. Removal/Installation
   A. Remove Indicator
      (1) Assure that Battery Switches and Stall Warning Switches are off.
      (2) Lower pilot's instrument panel and disconnect electrical plug from indicator.
      (3) Loosen instrument clamp screws and remove indicator from panel.
   B. Install Indicator
      (1) Install indicator in panel and secure with instrument clamp.
      (2) Connect electrical plug to indicator.
      (3) Raise and secure pilot's instrument panel.

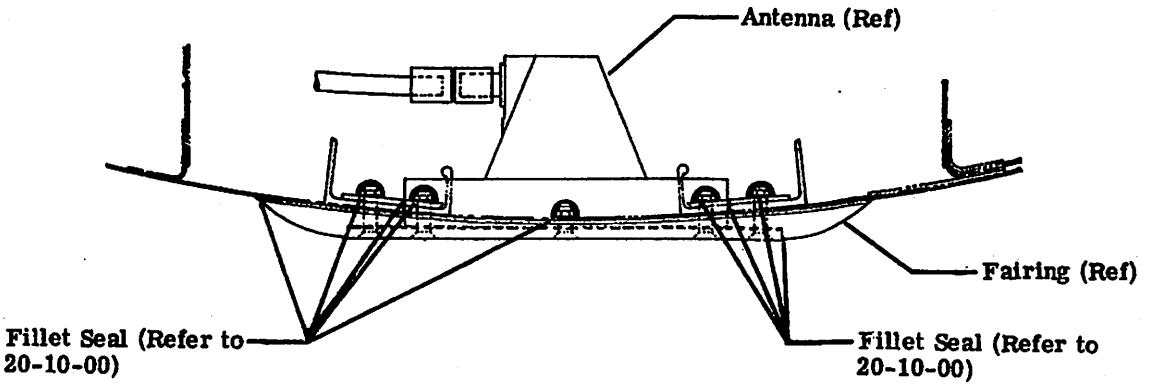
RADIO ALTIMETER ANTENNA - MAINTENANCE PRACTICES

1. General
   A. Two radio altimeter antennas are installed in the aircraft. One is located just aft of frame 10 and the other aft of frame 12.

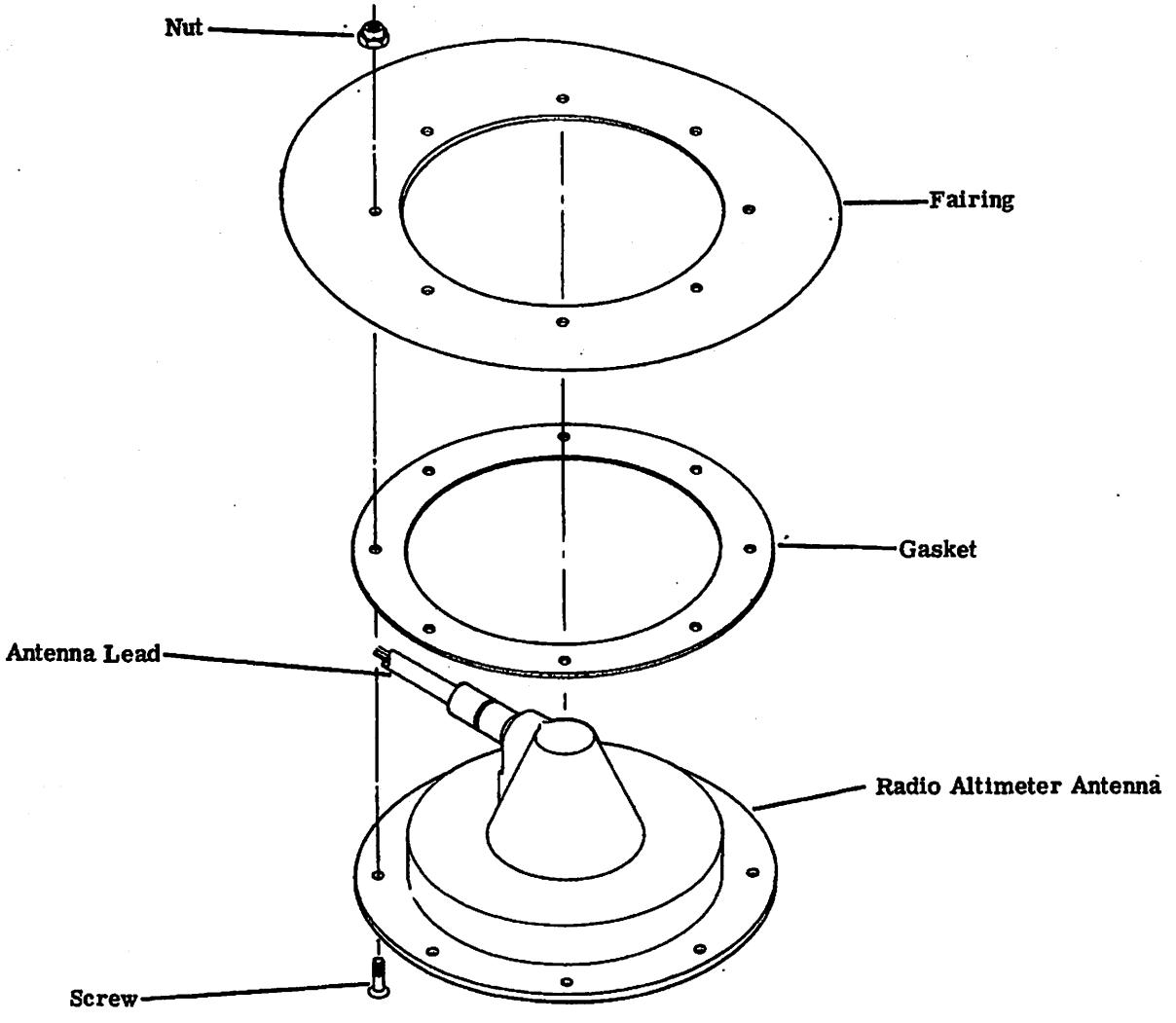
2. Removal/Installation

   NOTE: The following removal and installation procedures are identical for both antennas.

   A. Remove Antenna (See figure 201)
      (1) Remove carpet and floorboards to gain access to the antenna installation.
      (2) Disconnect antenna lead from antenna.
      (3) Remove sealant from attaching parts.
      (4) Remove attaching parts and antenna gasket and fairing from aircraft.
      (5) Remove old sealant from structure and clean surface with MEK.
   B. Install Antenna (See figure 201)
      (1) Install fairing, gasket and antenna and secure with attaching parts.
      (2) Apply fillet seal to attaching parts and around perimeter of antenna (interior and exterior). (Refer to 20-10-00)
      (3) Connect antenna lead.
      (4) Install floorboards and carpets.



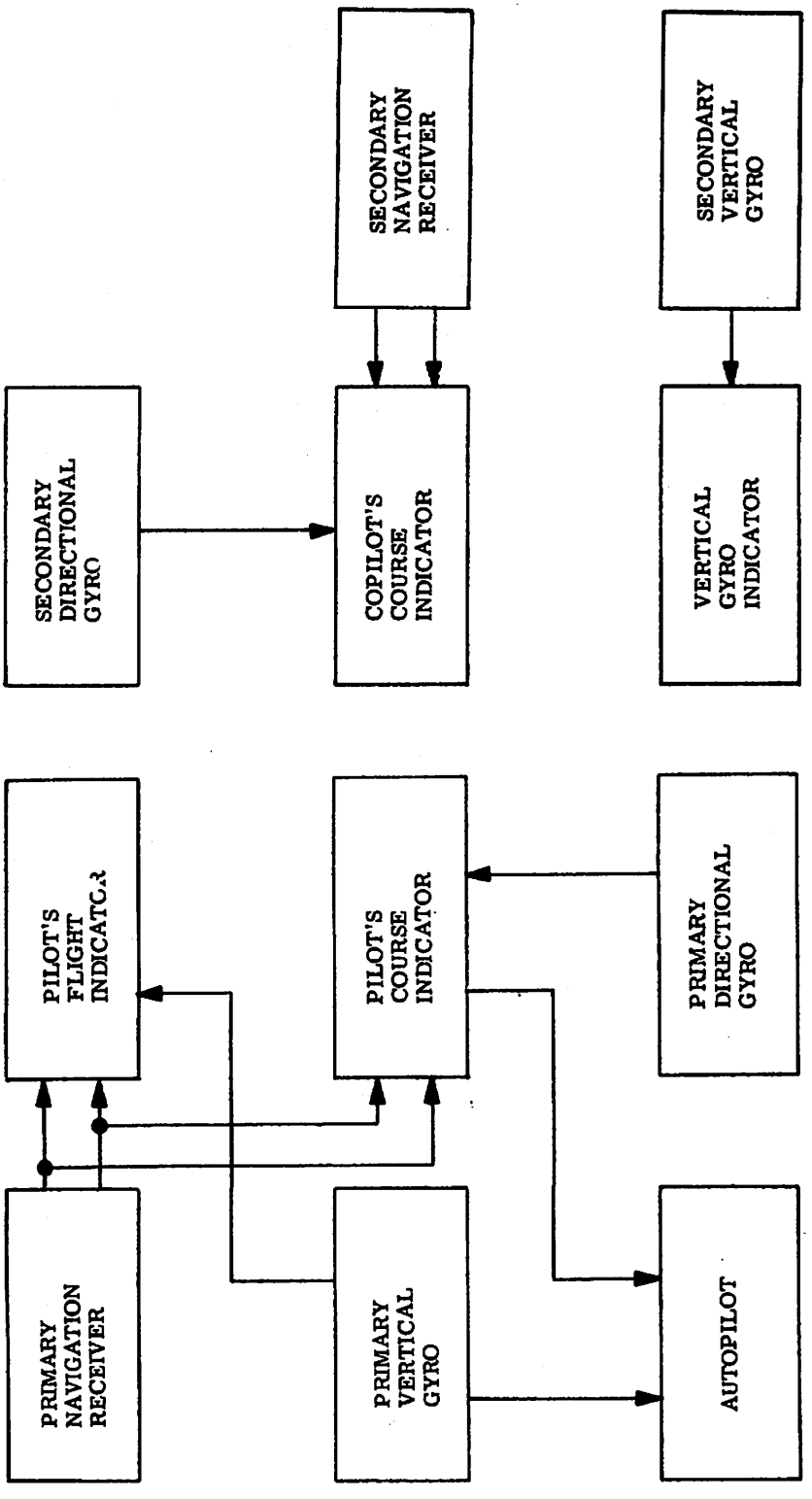
PLAN VIEW OF ANTENNA



Radio Altimeter Antenna Installation
Figure 201

ATTITUDE AND DIRECTION - DESCRIPTION AND OPERATION

1. General
   A. Attitude and direction instrumentation includes those systems necessary for basic flight maneuvers.
   B. The systems include the flight directors, turn and bank, turn coordinator, directional gyros, vertical gyros, a vertical gyro indicator, and a magnetic compass.



Attitude and Direction Block Diagram
Figure 1

MAGNETIC COMPASS - MAINTENANCE PRACTICES

1. Description
   A. The compass is a short-period magnetic compass intended to indicate continuously the aircraft heading with reference to the earth's magnetic field. It is equipped with and instrument light and a compensating system. A compass correction card is carried on the mounting bracket.

2. Removal/Installation
   A. Remove Magnetic Compass (See figure 201)
      (1) Remove upholstery as required to gain access to magnetic compass.
      (2) Disconnect compass light electrical wiring at splice.
      (3) Remove attaching parts and compass from bracket.
   B. Install Magnetic Compass (See figure 201)
      (1) Connect compass light electrical wiring.
      (2) Install compass and secure with attaching parts.
      (3) Install previously removed upholstery.

3. Adjustment/Test
   A. Magnetic Compass Compensation (See figure 202)
      (1) Place the aircraft on a compass rose and level. (Refer to Chapter 8.)
      (2) Loosen and swing compensator coverplate up out of the way.
      (3) Turn the "N-S" and "E-W" compensator adjustment shafts to the null position by aligning the dot on the shafts with the dots on the compensator case. For this, as well as all other adjustments, use a non-magnetic screwdriver.

          NOTE: When determining or adjusting the compass readings on all headings, both engines shall be running and all normal operating flight equipment turned on.

      (4) Align the aircraft, setting it on 0°, 30°, 60°, 90°, 120°, 150°, 180°, 210°, 240°, 270°, 300° and 330° magnetic headings. At each heading, read the magnetic compass and the directisyn (primary and secondary from pilot's side). Record the readings. The reading for the magnetic compass shall not vary more than 5° from the magnetic heading at any check point or the compass shall be recompensated or replaced. Record the corrected compass reading in the "Steer" columns of the compass correction card next to the true heading in the "To Fly" column for 0°, 30°, 60°, 90°, 120°, 150°, 180°, 210°, 240°, 270°, 300° and 330°.
      (5) The compass should be compensated using coefficients "B" and "C" as explained in the following example:

(a) Assuming that the compass headings, readings and deviations are:

Magnetic Heading	Compass Reading	Deviation
180°	178°	2
270°	274°	-4
0°	6°	-6
90°	90°	0

(b) Coefficient "C": $C = \frac{N-S}{2}$ or $C = \frac{(-6°) + (+2°)}{2} = 2°$, therefore, with the airplane on a north magnetic heading (actual compass reading 358°), turn the N-S compensator until the compass reads 0°.

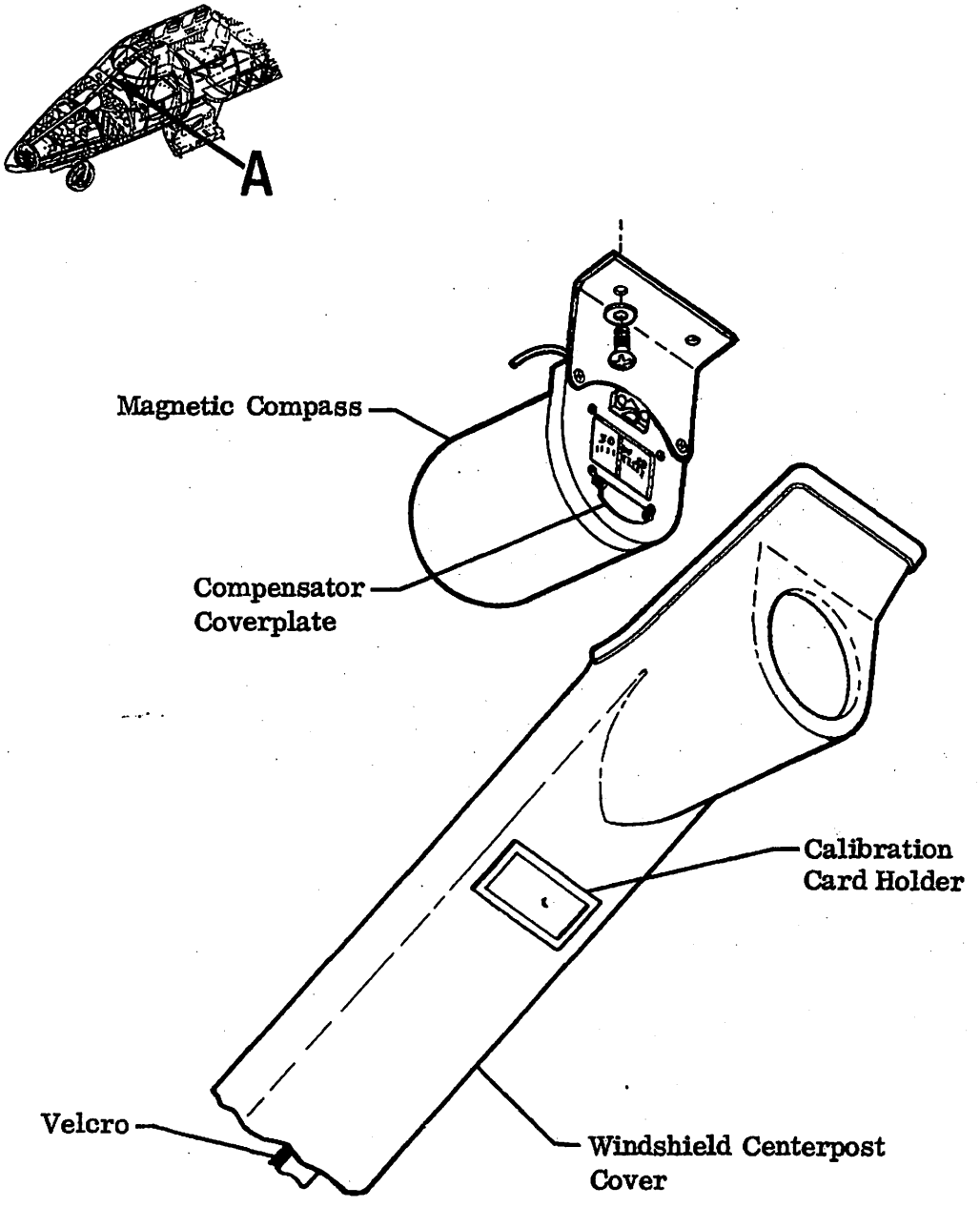
NOTE: For all practical purposes, disregard any fraction of a degree when compensating the compass.

(c) Coefficient "B": $B = \frac{E-W}{2}$ or $\frac{(0°) + (-4°)}{2} = -2°$; therefore, with the airplane on east magnetic heading (actual compass heading 88°), turn the E-W compensator until the compass reads 90°.

(6) Position aircraft on primary and secondary magnetic headings and record magnetic headings and corresponding compass readings in their proper columns.

(7) Fill out "Steer" column by making a residual swing through all 24 positions. Then fill in blanks on back of card. Tear off compass card and place it in the cockpit compass card holder. File remainder of card as a permanent record.

(8) Position compensator coverplate over compensator and tighten screws.



Detail A

Magnetic Compass Installation
Figure 201

ACTUAL HEAD	MAGNETIC READING	MAGNETIC DEV'N
N 000		
S 180		
E 090		
W 270		
COEF C $C = \frac{(N) - (S)}{2}$	$\frac{(\ ) - (\ )}{2} =$	
COEF B $B = \frac{(E) - (W)}{2}$	$\frac{(\ ) - (\ )}{2} =$	
COEF A $\frac{(N) + (E) + (S) + (W)}{4}$	$\frac{(\ ) + (\ ) + (\ ) + (\ )}{4} =$	

ACTUAL HEAD	PRIMARY READING	PRIMARY DEV'N	SECONDARY READING	SECONDARY DEV'N	MAGNETIC READING	MAGNETIC DEV'N
000						
030						
060						
090						
120						
150						
180						
210						
240						
270						
300						
330						

Magnetic Compass Deviation Worksheet
Figure 202

DIRECTIONAL GYRO - DESCRIPTION AND OPERATION

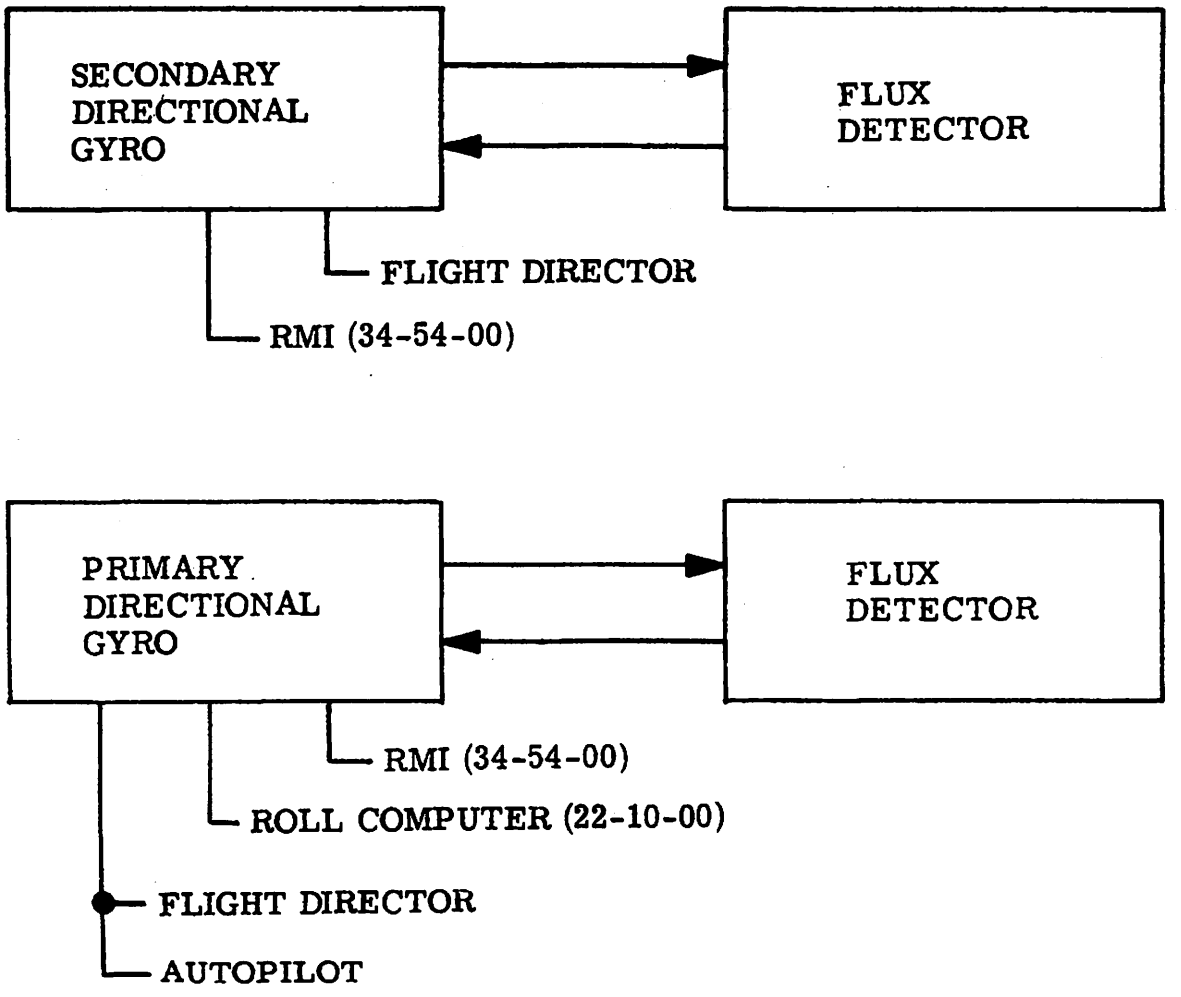
1. General
   A. The directional gyros are installed in shock mounted racks in the nose compartment. The racks incorporate hold-down clamps and a receptacle box. All electrical connections are made when the gyro unit is in place and secured to the rack.
   B. The flux valve is installed on a mounting bracket in the tailcone of each tip tank. This location minimizes electrical and magnetic disturbances of the aircraft. The flux valve assembly includes a compensator.
   C. Maintenance practices consist of replacement of defective components.

2. Description
   A. The directional gyro system provides a full 360 degrees of heading information with standard ARINC levels and gradients. The directional gyro contains an electrically-driven, hermetically-sealed gyro that is slaved to Magnetic North by the externally mounted flux valves and an internal servo-amplifier loop. Cockpit controls provide a free mode of operation which can be selected whenever magnetic operation is unreliable.

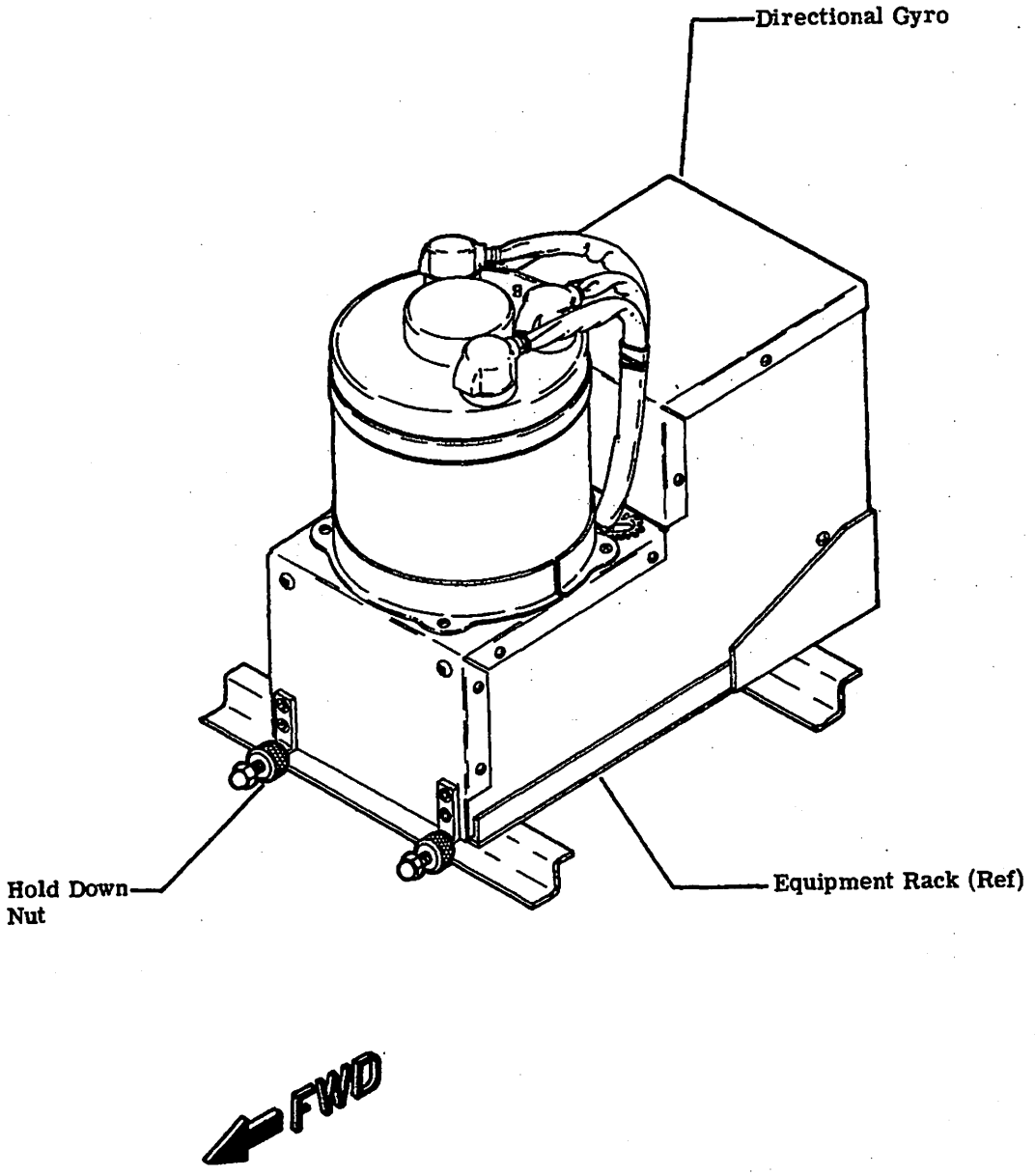
3. Removal/Installation

   NOTE: Removal and installation procedures for both directional gyros are identical.

   A. Remove Directional Gyro (See figure 202)
      (1) Remove nose compartment access doors.
      (2) Loosen gyro hold down screws.
      (3) Disengage hold down screws and pull gyro from rack.
   B. Install Directional Gyro (See figure 202)
      (1) Position gyro on rack and slide gyro into rack engaging electrical connector.
      (2) Engage and secure hold down screws.
      (3) Install nose compartment access doors.



Primary and Secondary Directional Gyro Block Diagram
Figure 201



Directional Gyro Installation
Figure 202

EFFECTIVITY: ALL

FLUX VALVE - MAINTENANCE PRACTICES

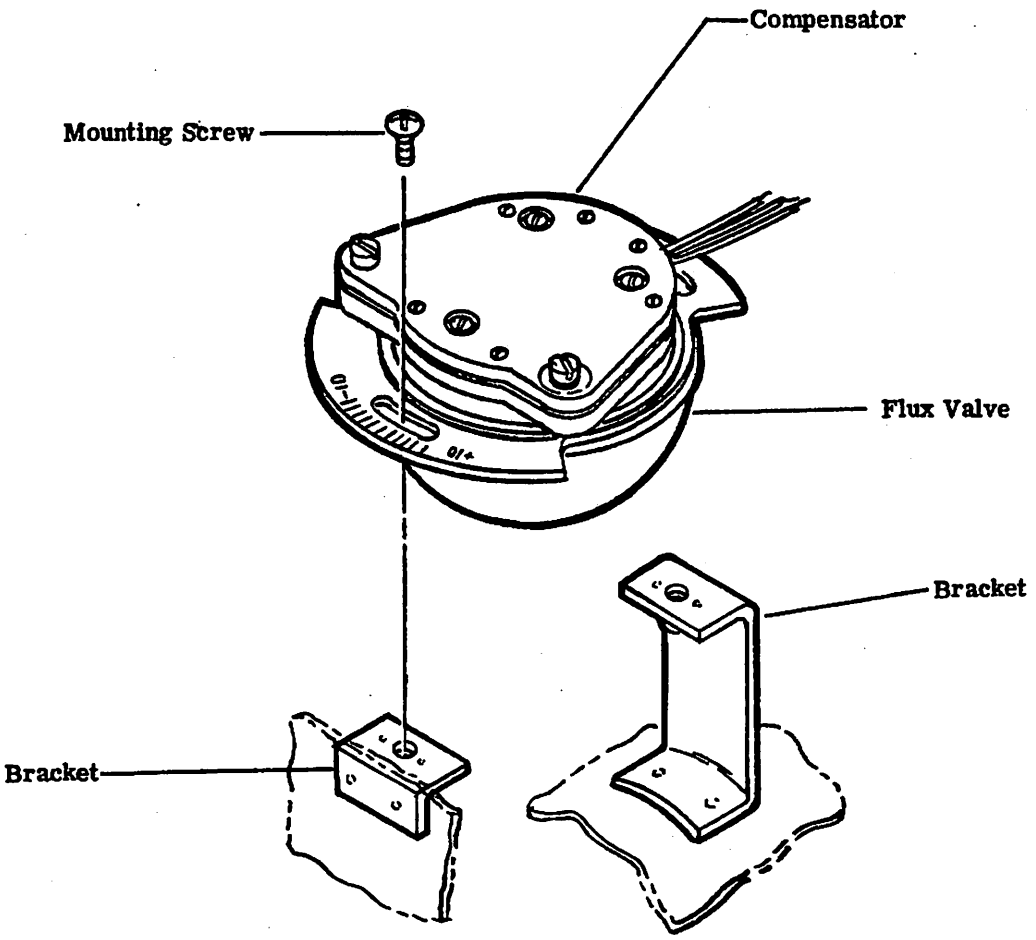
1. General
   A. Maintenance practices consist of flux valve calibration and replacement of defective component.

2. Removal/Installation

   NOTE: Removal and installation procedures for both flux valves are identical.

   A. Remove Flux Valve (See figure 201)
      (1) Remove tip tank tailcone.
      (2) Remove attaching parts and compensator (if installed).
      (3) Disconnect electrical wiring from flux valve. Tag electrical wiring.
      (4) Remove attaching parts and flux valve from mounting bracket.
   B. Install Flux Valve (See figure 201)
      (1) Install flux valve on mounting bracket and install screws. Do not tighten screws at this time.
      (2) Connect electrical wiring to flux valve.
      (3) Perform calibration adjustment of flux valve.
      (4) Install tip tank tailcone.

3. Adjustment/Test
   A. Calibration Adjustment of Flux Valve
      (1) Remove tip tank tailcone.
      (2) Position the aircraft to a known heading, preferably to Magnetic North.
      (3) Set the aircraft Primary Inverter Switch to the ON position. After 90 (±18) seconds, the GYRO flag on the heading indicator will disappear and the Directisyn will become operative.
      (4) Rotate the flux valve until the annunciator nulls and the heading indicator indicates NORTH or to the heading of the aircraft. If the correct indications cannot be obtained, perform step (7).
      (5) Tighten mounting screws.
      (6) Position the aircraft to several known headings; the heading indicator should track the aircraft position ±2°.
      (7) If the error in step (6) was greater than ±2°, install the compensator on the flux valve and recalibrate.
      (8) Rotate the flux valve and then adjust the NS and EW adjustment screws on the compensator as necessary to decrease the heading error to 2° or less.
      (9) Tighten mounting screws.
      (10) Repeat step (6). If the error is greater than 2°, repeat step (8).
      (11) Install tip tank tailcone.



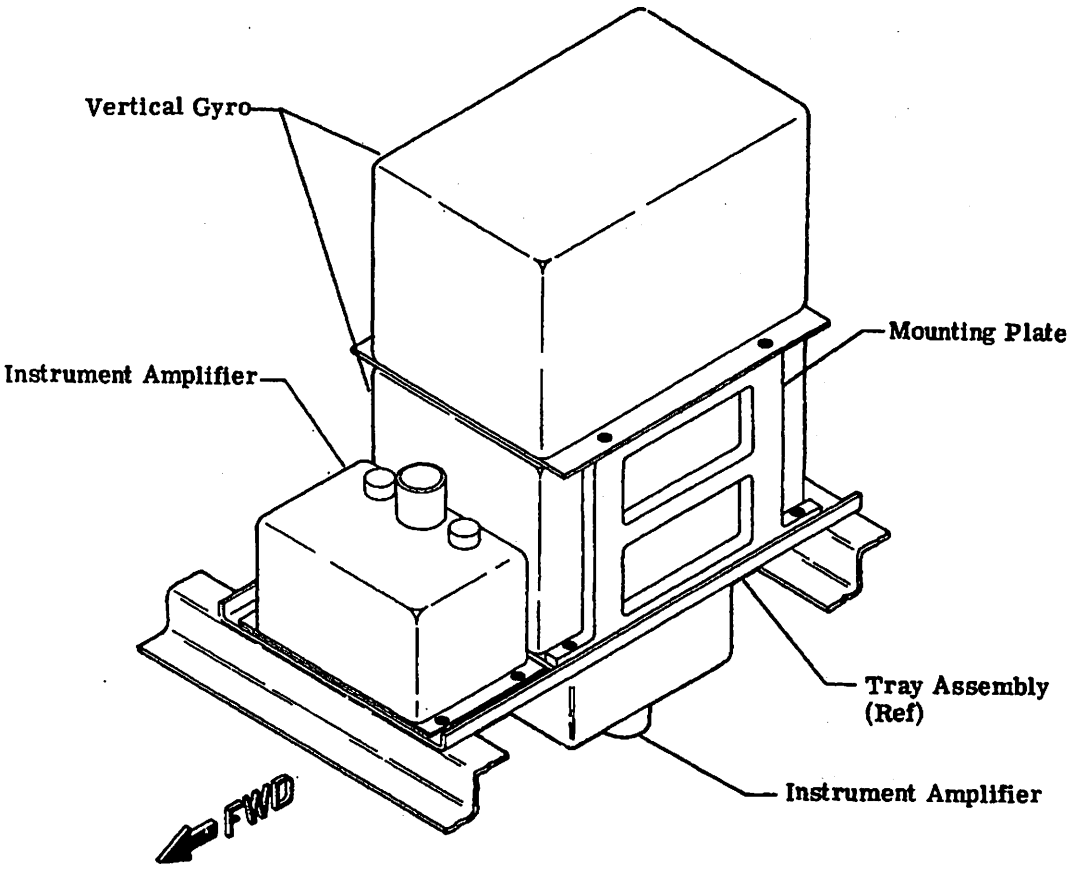
TYPICAL

Flux Valve Installation
Figure 201

VERTICAL GYRO - MAINTENANCE PRACTICES

1. General
   A. The vertical gyros are installed in the nose compartment.

2. Removal/Installation
   A. Remove Vertical Gyro (See figure 201)
      (1) Remove nose compartment access doors.
      (2) Disconnect electrical plug from gyro.
      (3) Remove attaching parts and vertical gyro from aircraft.
   B. Install Vertical Gyro (See figure 201)
      (1) Install gyro and secure with attaching parts.
      (2) Connect electrical plug to gyro.
      (3) Install nose compartment access doors.



Vertical Gyro Installation
Figure 201

FLIGHT DIRECTORS AND COURSE INDICATORS - MAINTENANCE PRACTICES

1. General
   A. Maintenance practices for the flight directors, course indicators, and vertical gyro indicator consist of replacement and functional test.

2. Removal/Installation

   NOTE: The following removal and installation procedures are common to the flight directors, course indicators and vertical gyro indicator.

   A. Remove Indicator
      (1) Assure that Battery Switches and Stall Warning Switches are off.
      (2) Lower pilot's or copilot's instrument panel.
      (3) Disconnect electrical plug(s) from indicator.
      (4) Loosen instrument clamp screw and remove indicator from panel.
   B. Install Indicator
      (1) Install indicator in panel and secure with instrument clamp.
      (2) Connect electrical plug to indicator.
      (3) Raise and secure instrument panel.

3. Adjustment/Test
   A. The following functional test procedures are for the Sperry (Stars IVB) Flight Director System.
   B. Tools and Equipment required for functional test are as follows:

NAME	NUMBER	MANUFACTURER	USE
Turn Table (3-axis) and TARSYN Extension Cables			
LOC-G/S-Marker	G-250C 479T-2	Gables Collins	
External Power Supply (28 vdc)			

C. Functional Test of Sperry (Stars IVB) Flight Director System

NOTE: The following tests are applicable for both single or dual STARS IVB Flight Director Systems except where noted.

(1) Install TARSYN (3-axis reference sensor) on turn table and connect to aircraft wiring by extension cables.
(2) Connect external power to aircraft and set Battery Switches to "on".
(3) Set Inverter Switches to on.
(4) Check for 28 vdc on DC voltmeter and check for 115 volts on AC voltmeter.
(5) Computer light check
  (a) Check that Navigation Receiver (AC and DC), RMI, Directional and vertical Gyros and Flight Director (AC and DC) circuit breakers are on.

    NOTE: The Flight Director Computer/Controller (ZC-200) displays three levels of light brightness; day bright, night bright and soft background glow for button identification. The background glow will be observed whenever 28 volts DC is applied to the system.

  (b) Turn aircraft navigation light switch to OFF position. Press the standby (STBY) mode on ZC-200. Observe that all mode annunciators button go to day bright intensity. Release STBY button and observe that all annunciators except STBY return to background intensity.
  (c) Place aircraft navigation light switch to ON position and press STBY button on ZC-200. Observe that all the annunciators glow in the night bright level of illumination. Release the STBY button.
(6) Heading Check

    NOTE: The pilot's Radio Deviation Indicator (RD-444) corresponds to the copilot's RMI and copilot's RD-444 corresponds to the pilot's RMI.

  (a) Set directional gyro FREE-SLAVED switch to SLAVED position.

(b) Observe that the Compass Flag (COMP) is out of view after nominal time 2 minutes and that the RD-444 Indicator heading and corresponding RMI heading slave to the aircraft heading.

(c) Observe that Compass Synchronization Annunciator is either alternately showing dot and cross or that only a part of each is in view.

(d) Rotate the TARSYN 90° clockwise. Observe that the RD-444 Indicator and corresponding RMI increases heading 90° ±2°.

(e) Rotate the TARSYN 180° counterclockwise. Observe that the RD-444 Indicator and corresponding RMI decreases heading 90° ±2° from the original aircraft heading.

(f) Return TARSYN to the slaved aircraft heading.

(g) Rotate the TARSYN 10° clockwise. Observe the slow slaving of the TARSYN, indicated by the RD-444 slowly moving to the aircraft heading at a nominal 2° per minute.

(h) Hold the INC-DEC switch to DEC. Observe the fast slave of the TARSYN. This is indicated by the RD-444 heading moving to the aircraft heading at greater than 30° per minute.

(i) Rotate the TARSYN 10° counterclockwise from the aircraft heading. Observe the slow slaving of the TARSYN, indicated by the RD-444 slowly moving to the aircraft heading. Observe for nominal 2° per minute slaving rate.

(j) Hold the fast slave INC-DEC switch to INC. Observe the fast slave of the TARSYN indicated by the RD-444 moving to the aircraft heading at greater than 30° per minute.

(k) Set the FREE-SLAVE switch to FREE position. With INC-DEC switch, increase the RD-444 heading 10°. Observe that the annunciator on the RD-444 indicates null.

(l) Return the FREE-SLAVED switch to the SLAVED position. Observe that the annunciator on the RD-444 indicates a dot. The compass card shall slowly synchronize to the magnetic heading, at which time the annunciator shall indicate a null. Set the FREE-SLAVED switch to FREE position. Observe that the annunciator on the RD-444 indicates null.

(m) With INC-DEC switch, decrease the RD-444 heading 10°. Observe that the annunciator on the RD-444 indicates null.

(n) Return the FREE-SLAVED switch to the SLAVED position. Observe that the annunciator on the RD-444 indicates a cross. The compass card shall slowly synchronize to the magnetic heading, at which time the annunciator shall indicate a null.

GATES LEARJET CORPORATION maintenance manual

(o) Put the FREE-SLAVED switch to FREE position, observe that the annunciator on the RD-444 indicates null.

(p) Return the FREE-SLAVE switch to SLAVE position.

NOTE 1: When the INC-DEC switch is held in either position in either FREE or SLAVE, the RD-444 Compass Flag (COMP) appears. The COMP flag is in view before the Directional Gyro normal erection cycle is completed. Anytime the gyro is in fast slave, during AC power off.

NOTE 2: To prevent extreme bank attitudes, the computer limits the amount of roll angle commanded to a maximum approximately 30°.

(7) HZ-444 and/or HZ-454 Attitude Gyro Check

NOTE: During the check of the HZ-454 Indicator, both Pitch and Roll input data must be present for the single-cue command bar to be in view. If either signal is invalid the bar will be biased out of view.

(a) Select Standby (STBY) mode on the ZC-200 Flight Director Computer/Controller. Observe that both Flight Director Bars and the Flight Director Flag (FD) on the HZ-444 are retracted from view or that the single-cue command bar on the HZ-454 is retracted from view.

(b) Observe that the HZ-444 and/or the HZ-454 Flight Director Gyro Flag (ATT) is retracted from view after Vertical Gyro normal erection cycle is completed in a nominal 3-minutes after AC power is supplied to the TARSYN.

NOTE: HZ-444 and/or HZ-454 Flight Director Indicator gyro flag (ATT) is in view when: Vertical Gyro is in Fast Erect before normal erection cycle is completed, vertical gyro Fast Erect Switch is held ON, AC power is OFF, Vertical gyro or flight director circuit breakers are open.

(c) Push the HZ-444 and/or the HZ-454 Indicator ATT TEST switch. Observe that the HZ-444 and/or the HZ-454 indicator pitch attitude display indicates 10° ±4° climb. Observe that the HZ-444 and/or the HZ-454 Indicator roll attitude display indicates 20° ± 4° right roll (bank index left of center).

(d) Tilt the TARSYN 10° nose up. Observe that the HZ-444 and/or the HZ-454 indicator pitch attitude display indicates 10° ±2° climb.

(e) Tilt the TARSYN 10° nose down. Observe that the HZ-444 and/or the HZ-454 indicator pitch attitude display indicates 10° ±2° dive.

(f) Tilt the TARSYN 60° nose down. Observe that the HZ-444 and/or the HZ-454 indicator pitch attitude display indicates 60° ±4° dive when aligned with the vertex of the white V marking.

(g) Tilt the TARSYN 60° nose up from level. Observe that the HZ-444 and/or the HZ-454 indicator pitch attitude display indicates 60° ±4° climb when aligned with the vertex of the white V marking.

(h) Level TARSYN in roll and pitch attitude.

(i) Roll TARSYN to a 30° right roll. Observe that the HZ-444 and/or the HZ-454 roll attitude display and roll bank index at top of instrument indicate 30° ±3° right roll index left of center line.

NOTE: TARSYN roll and pitch position indicate degree per degree on the HZ-444 and/or the HZ-454 indicator.

(j) Position the TARSYN to 60° right roll. Observe the HZ-444 and/or the HZ-454 indicator attitude display and bank index indicate 60° ±4° right roll.

(k) Position the TARSYN to 30° left roll. Observe that the HZ-444 and/or the HZ-454 indicator attitude display and bank index indicate 30° ±3° left roll.

(l) Position the TARSYN to 60° left roll. Observe the HZ-444 and/or the HZ-454 indicator attitude display and bank index indicate 60° ±4° left roll.

(m) Level the TARSYN in roll and pitch attitude.

(8) Flight Director Heading (HDG) Mode Check

(a) Select Standby (STBY) Mode on the ZC-200 Flight Director Computer/Controller. Observe both flight director bars and/or single-cue command bar is out of view.

(b) Select Heading (HDG) Mode on the ZC-200 Flight Director Computer/Controller. Observe that the vertical flight director bar on the HZ-444 is in view and only the HDG lamp

ON. If the HZ-454 is used during this test in place of the HZ-444 the TARSYN must be level and must supply both Roll and Pitch data to the HZ-454. Therefore, select the HDG Mode followed by the PAT Mode on the ZC-200 Flight Director Computer/Controller.

(c) Move the Heading bug of the RD-444 course indicator to the aircraft heading with the heading select knob. Observe that the vertical flight director bar and/or the single-cue command bar centers.

(d) Move the Heading bug -20° from aircraft heading. Observe that the vertical flight director bar and/or the single-cue command bar indicates Fly-Left.

(e) Move the Heading bug -20° from aircraft heading. Observe that the vertical flight director bar and/or the single-cue command bar indicates Fly-Left.

(f) Press the INC-DEC switch to either position. The compass flag will come into view and the vertical flight director bar and/or the single-cue command bar should be out of view.

(9) Flight Director Pitch Attitude Trim (PAT) Check for HZ-444.

(a) Select pitch attitude trim (PAT) mode on the ZC-200. Both horizontal and vertical flight director bars should be in view.

(b) Center the PAT knob on the HZ-444.

(c) TARSYN level. Observe that the attitude display is level and the vertical and horizontal flight director bars are centered.

(d) Move the pitch attitude trim (PAT) knob clockwise to the full up position. Observe that the horizontal flight director bar moves up and requires 15° ±2° nose up attitude of the TARSYN to align the horizontal flight director bar on the reference aircraft.

(e) Move the Pitch Attitude Trim (PAT) knob counterclockwise to the down position. Observe that the horizontal flight director bar moves down and requires 15° ±2° nose down attitude of the TARSYN to align the horizontal flight director bar on the reference aircraft.

(f) Return the TARSYN to level. PAT knob centered, observe that the horizontal flight director bar indicates zero (centers).

(g) Position the TARSYN 30° climb. Observe that the horizontal flight director bar will command Fly-Down.

(h) Tilt the TARSYN 30° dive. Observe that the horizontal flight director bar will command Fly-Up.

(i) Level TARSYN and observe that the horizontal flight director bar will indicate zero (centers).

(j) Test the SMART function by pressing the vertical gyro FAST ERECT switch. Observe that the attitude flag (ATT) comes

into view and the horizontal flight director bar goes out of view.

(10) Pitch Synchronization Check for the HZ-454
  (a) Set TARSYN level. Select Pitch synchronization on bezel of HZ-454 and observe that the stationary aircraft symbol is centered in the Flight Director single-cue command bar.
  (b) Tilt the TARSYN for 15° climb. Observe that the flight director single-cue command bar will command fly-down.
  (c) Select Pitch synchronization on Bezel of the HZ-454 and observe that the stationary aircraft symbol and the Flight Director single-cue command bar are centered.
  (d) Tilt the TARSYN for 20° climb. Observe that the Flight Director single-cue command bar will command fly down.
  (e) Tilt the TARSYN for 10° climb. Observe that the Flight Director single-cue command bar will command fly-up.
  (f) Tilt the TARSYN for 15° dive. Select pitch synchronization on the Bezel of the HZ-454 and observe that the stationary aircraft symbol is centered in the Flight Director single-cue command bar.
  (g) Tilt the TARSYN for 20° dive. Observe that the Flight Director single-cue command bar will command fly-up.
  (h) Tilt the TARSYN for 10° dive. Observe that the Flight Director single-cue command bar will command fly-down.
  (i) Return TARSYN to level. Select Pitch synchronization with yoke mounted switch. Observe that the Flight Director single-cue command bar returns from fly down command and centers on stationary aircraft symbol.

(11) Flight Director Vertical Bar and/or Single-cue Command Bar
  (a) Select Standby (STBY) Mode on ZC-200 and select Heading (HDG) Mode on ZC-200 for the HZ-444 or select the HDG Mode followed by PAT Mode on ZC-200 for the HZ-454.
  (b) Position the TARSYN 30° right roll. Observe that the vertical flight director bar and/or the single-cue command bar will command Fly-Left.
  (c) Position the TARSYN 30° left roll. Observe that the vertical flight director bar and/or the single-cue command bar will command Fly-Right.

(12) Flight Director V/L Mode VOR
  (a) NAV Control ON.
  (b) Set NAV control to a VOR simulator frequency. Adjust the simulator bearing to the aircraft heading.
  (c) Select Standby (STBY) Mode on ZC-200 and select V/L Mode on the ZC-200 when using the HZ-444 or select V/L Mode followed by PAT Mode on the ZC-200 when using the HZ-454.

(d) Set Course Select Pointer of the RD-444 to the aircraft heading. Observe that the NAV flag of the RD-444 indicator, the Expanded Localizer/Symbol and Glide Slope pointers are out of view. The course deviation bar is centered and the TO ambiguity annunciator of the RD-444 indicator is in view.

(e) Move the Course Select Pointer plus 10° ±2° from the aircraft heading. Observe that the Course Deviation bar moves to last dot (150 micro amps) left and the vertical flight director bar and/or the single-cue command bar commands Fly-Left.

(f) Move the Course Select Pointer -10° ±2° from the aircraft heading. Observe that the Course Deviation bar moves to last dot (150 micro amps) right and the vertical flight director bar and/or the single-cue command bar commands Fly-Right.

(g) Rotate the Course Select Pointer to the reciprocal course. Observe that the Course Deviation bar centers and the FROM ambiguity annunciator is in view.

NOTE: The TO/FROM ambiguity annunciator is hidden from view at ±90° from course. Partial indication may be observed from ±70° and ±110° off course.

(h) With the Course Select Pointer set aircraft heading increase the simulator bearing by 15°. Observe that the Course Deviation bar indicates Fly-Right and the vertical flight director bar and/or the single-cue command bar indicates Fly-Right.

NOTE: To prevent extreme bank attitudes, the computer limits the roll angle commanded so the aircraft never exceeds approximately 30° of bank.

(13) Flight Director V/L Mode Localizer Check

(a) Establish the following conditions:

(1) TARSYN vertical and directional gyros fully erected to the aircraft heading and level in roll and pitch.
(2) HZ-444 Pitch Attitude Trim Knob centered and/or the HZ-454 Pitch Sync Switch closed.
(3) Course select pointer set on the aircraft heading.
(4) Glide Slope Circuit Breaker ON.
(5) NAV receiver on a localizer frequency.
(6) NAV simulator ON.
(7) Press Standby (STBY) Mode then V/L Mode on ZC-200 flight director computer/controller when using the HZ-444. Follow F/L Mode with PAT Mode when using the

HZ-454. NAV flag on RD-444 should be retracted from view.

(b) Set the NAV simulator from an on-course signal to a Fly-Right signal. Observe that the Course Deviation bar and the Expanded Localizer pointer display a Fly-Right indication at one dot (75 micro amps).

(c) Observe that the vertical flight director bar and/or the single-cue command bar is commanding Fly-Right.

(d) With the Fly-Right Course Deviation indication, observe that a decrease of the Course Select pointer will center the vertical flight director bar and/or the single-cue command bar.

(e) With the Course Select pointer on the aircraft heading, set the NAV simulator to a Fly-Left signal. Observe that the Course Deviation bar and the Expanded Localizer pointer display a Fly-Left indication.

(f) With the Fly-Left Course Deviation indicated, observe that an increase of the Course Select pointer will center the vertical flight director bar and/or the single-cue command bar.

NOTE: The Expanded Localizer pointer may be out of view if the signal is large enough to cause the Deviation Bar to move more than 30 micro-amperes.

(14) Flight Director Reverse Course Check

(a) Select Standby (STBY) Mode and then reverse course mode on the ZC-200 when using the HZ-444. Select PAT mode when using the HZ-454. Verify that the REV mode cannot be engaged until a localizer frequency is selected, also if the NAV flag is not out of view, the vertical flight director bar and/or the single-cue command bar will not be in view. This checks the SMART function. Observe that the REV mode on the ZC-200 is displayed, regardless of whether the NAV flag is valid or invalid as long as a localizer frequency is selected.

(b) In Reverse Course Mode simulate a Fly-Right localizer signal from the simulator and position the RD-444 Course Set pointer to the reciprocal of the aircraft heading. Observe that the Course Deviation bar indicates Fly-Left. The Expanded Localizer indicates Fly-Left and the vertical flight director bar and/or the single-cue command bar indicates Fly-Left.

(c) In Reverse Course Mode select an On-Course localizer signal on the simulator. With the RD-444 Deviation bar centered, move the course select +20° from the reciprocal of the heading. Observe that the vertical flight director bar and/or the single-cue command bar indicates Fly-Right.

(d) Change the NAV control to a 100 KH_z higher (or lower) frequency. Observe that the vertical flight director bar on the HZ-444 or the single-cue command bar on the HZ-454 goes out of view.

(15) Flight Director Glide Slope Check

(a) Turn the NAV control ON. Glide Slope Circuit Breaker ON. Set LOC/VOR Glide Slope Simulator to same frequency as the aircraft NAV control. Simulator to an On-Course Localizer and Glide Slope fly-up signal (150 micro-amps).

(b) ZC-200 Flight Director Computer/Controller to Glide Slope Arm (GS ARM) mode (press the GS ARM push-button). Observe that V/L mode engages simultaneously and that only the vertical flight director bar is in view for the HZ-444 and the single-cue command bar is not in view for the HZ-454. Select Pitch Attitude Trim (PAT) mode. Observe that it remains engaged and that the horizontal flight director bar and/or the single-cue command bar is in view. Observe the G/S Flag is retracted from view. Observe that Glide Slope Arm mode lamp (GS ARM) is on.

(c) Observe that the Glide Slope Deviation Indicator displays a 2 dot fly-up position.

(d) Set the simulator for a Glide Slope "center" signal. Observe that the GS Annunciator comes bright (GS capture) and the V/L lamp remains bright and the PAT lamp goes super dim. At the moment of GS capture the horizontal flight director bar and/or the single-cue command bar will deflect approximately 3/16 inch downward command to initiate the pitch down mode which will wash out back to a zero (centered) command in approximately 12 seconds. 1

(e) Set the simulator for a Glide Slope "down" signal. Observe that the Glide Slope Deviation pointer and horizontal flight director bar and/or the single-cue command bar move downward.

NOTE: The HZ-444 Pitch Attitude Trim knob has no control while in Glide Slope (GS) mode.

(f) Move the TARSYN to a nose down attitude until the horizontal flight director bar and/or the single-cue command bar is centered.

NOTE: The TARSYN Pitch Attitude required to cancel a full Glide Slope signal in GS mode should not exceed 10°.

(g) Return the TARSYN to level.
(h) Glide Slope Extension (GS EXT) mode is fully automatic and is engaged as a function of 250 feet radio absolute altitude (radio altimeter height above the terrain) or middle marker sensing, whichever occurs first.
(i) Set the simulator for a Glide Slope On-Course signal.
(j) Set the simulator for a Middle Marker signal.
(k) Marker Circuit Breaker and Switch ON.
(l) Observe that the Middle Marker Light is ON and Flight Director Computer/Controller (GS EXT) light is ON.
(m) Set the Simulator for Glide Slope down signal. Observe that the Glide Slope Deviation pointers and horizontal flight director and/or single-cue command bar move down.
(n) Move the TARSYN to a nose down attitude until the horizontal flight director and/or single-cue command bar is centered.

NOTE: The TARSYN pitch attitude required to cancel a full Glide Slope signal in GS EXT mode should not exceed 10°.

(16) Flight Director Go Around Check
(a) Select the Standby (STBY) and then Go Around mode. Go Around mode is selected either by pressing the GO AROUND push-button on the ZC-200 computer/controller or by pressing the Go Around Switch on the pedestal.
(b) Observe that the GO AROUND mode is displayed, the horizontal flight director bar and/or single-cue command bar moves up and requires 8° to 12° TARSYN pitch up from level to align the Pitch horizontal flight director bar and/or the single-cue command bar with the reference aircraft.

(17) Flight Director Altitude Hold Check
(a) Level TARSYN. Select Standby (STBY) mode and then heading mode HDG and Pitch Attitude Trim (PAT) mode. Trim the horizontal flight director bar full up with the pitch attitude trim knob on the HZ-444.
(b) Press the Altitude Hold (ALT) push-button. Observe that the button (ALT) stays bright and the horizontal flight director bar descends to a center position for the HZ-444. Select Pitch synchronization for the HZ-454 and observe the single-cue command bar centered on the stationary aircraft symbol.
(c) Simulate a climb with a negative pressure on Altitude Static System. Observe that the horizontal flight director bar and/or the single-cue command bar indicates a dive (moves down)
(d) Simulate a dive with a positive pressure on the Altitude Static System. Observe that the horizontal flight director bar and/or the single-cue command bar indicates a climb (moves up).

(e) With the Altitude Hold (ALT) mode engaged select the Glide Slope Manual mode. Press GS push-button.
(f) Observe that the Altitude Hold (ALT) mode goes super dim and the GS mode simultaneously engages.
(g) With the Altitude Hold (ALT) mode disengaged, verify that the horizontal flight director bar is not affected by Static Simulator changes.

NOTE: To preclude extreme pitch attitudes, the pitch angle command is limited to approximately ±10° nose-up or nose-down. Besides, in order to provide override protection for the altitude controller, the ALT mode will be cancelled and the horizontal bar and/or the single-cue command bar will be removed from view anytime the aircraft deviates approximately ±400 feet from the engaged altitude.

(18) Internal Instrument and Mode Control Lighting
(a) Verify that the Flight Director RD-444 Indicator, the HZ-444 and/or the HZ-454 Indicator internal lights can be controlled with their respective panel light controls.
(19) Comparator Monitor Check (if applicable)

NOTE: In normal operation, all six warning annunciators and the warning monitor annunciator will be off.

(a) Disconnect the 26 volt AC (400 H_z) power to the CM-200. Observe that the MNTR lamp on the CM-200 and the master warning annunciator light.
(b) Press the WARN/DISABLE button on the CM-200. Observe that the master warning annunciator goes off and the MNTR lamp on the CM-200 remains on.
(c) Connect the 26 volt AC (400 H_z) power to the CM-200. Observe that the MNTR lamp on the CM-200 goes out.
(d) Simulate an error in roll and pitch attitude by pressing and holding the ATT TEST button on the copilot's HZ-444 and/or the HZ-454. Observe that the ROLL and PITCH lamps on the CM-200 and the master warning annunciator light.
(e) While holding the ATT TEST button, press the WARN/DISABLE button on the CM-200. Observe that the ROLL and PITCH lamps on the CM-200 and the master warning annunciator go out. Release the WARN/DISABLE button.
(f) Holding the ATT TEST button, press the TEST/RESET button on the CM-200. Observe that all warning annunciators on the CM-200 and the master warning monitor light.

(g) Release the TEST/RESET button. Observe that only the ROLL and PITCH lamps on the CM-200 and the master warning annunciator remain lighted.

(h) Release the ATT TEST button, then press it again. Observe that the ROLL and PITCH lamps on the CM-200 and the master warning annunciator light.

(i) Release the ATT TEST button. Observe that all warning lamps on the CM-200 and the master warning annunciator go off.

(j) Simulate an error in heading by using the copilot's INC-DEC switch. When the pilot's and copilot's heading indications (as indicated by their RD-444) differ by approximately 6°, the HDG lamp on the CM-200 and the master warning annunciator will light.

(k) Return the copilot's heading to the magnetic heading. Observe that the HDG lamp on the CM-200 and the master warning annunciator go out.

(l) Tilt the pilot's TARSYN-444 to simulate a bank of greater than 6°. Observe that the ROLL lamp on the CM-200 and the master warning annunciator light.

(m) Maintaining a bank of greater than 6° simulated by the pilot's TARSYN-444, repeat steps (j) and (k). The results will be the same, except that the HDG lamp on the CM-200 will come on at approximately 10° difference instead of 6°, and the ROLL lamp on the CM-200 and the master warning annunciator will be on throughout the steps.

(n) Return the pilot's TARSYN-444 to its normal position. Observe that the ROLL annunciator on the CM-200 and the master warning annunciator go out.

(o) Tune the pilot's and copilot's navigation receivers to the same ILS frequency. Press the GS buttons on the pilot's and copilot's ZC-200. Using the ILS TEST switches or simulator create a localizer deviation signal such that the pilot's and copilot's receivers differ by greater than 50 mv, and create a glidescope deviation signal such that pilot's and copilot's receivers differ by greater than 60 mv. Observe that the LOC and GS lamps on the CM-200 and the master warning annunciators light.

(p) Press the WARN DISABLE button on the CM-200. Observe that the LOC and GS lamps on the CM-200 and the master warning annunciators go out. Release the WARN DISABLE button and eliminate a signal difference between pilot's and copilot's receivers.

(q) Press the TEST RESET button on the CM-200. Observe that all warning lamps on the CM-200 and the master warning annunciators light. Release the TEST RESET button. Ob-

serve that all warning lamps on the CM-200 and the master warning annunciators go out.

(r) Press the STBY buttons on the pilot's and copilot's ZC-200.

(20) DRC-1 Dual Remote Compensator Check (if applicable)

NOTE 1: This check should not be performed after the compass swing is completed.

NOTE 2: DRC-1 has four potentiometers. Upper left potentiometer is for the primary (pilot) side North-South, lower left potentiometer is for the primary (pilot) side East-West, upper right potentiometer is for the secondary (copilot) side North-South and lower right potentiometer is for the secondary (copilot) East-West.

(a) Align the aircraft (or flux valve) to the north (approximately 0°) direction. Synchronize the RD-444 and read north (approximately 0°).

(b) Turn the North-South potentiometer clockwise. Observe that the annunciator on the RD-444 shows dot (.). Return the potentiometer to the center position.

(c) Turn the North-South potentiometer counterclockwise. Observe that the annunciator on the RD-444 shows cross (+). Return the potentiometer to the center position.

(d) Turn the aircraft (or flux valve) to the east (approximately 90°) direction. Synchronize the RD-444 and read east (approximately 90°).

(e) Turn the East-West potentiometer clockwise. Observe that the annunciator on the RD-444 shows dot (.). Return the potentiometer to the center position.

(f) Turn the East-West potentiometer counterclockwise. Observe that the annunciator on the RD-444 shows cross (+). Return the potentiometer to the center position.

(21) Set Battery and Inverter Switches to OFF.

(22) Disconnect external power supply from aircraft.

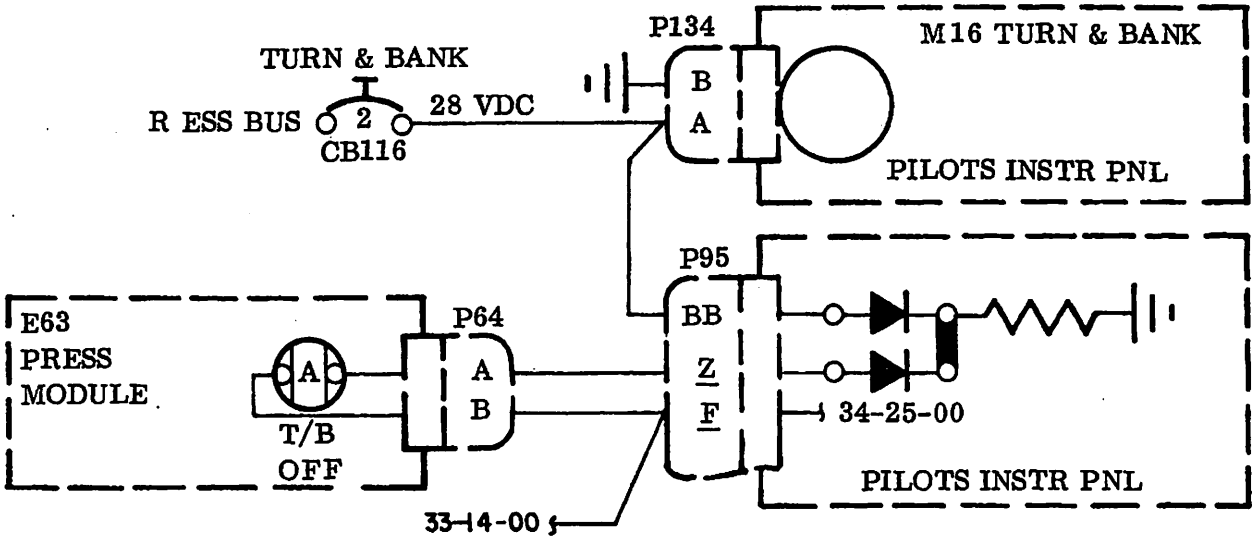
(23) Remove TARSYN-444 reference sensor in aircraft.

TURN AND BANK INDICATOR - MAINTENANCE PRACTICES

1. General
   A. The turn and bank indicator is installed in the copilot's instrument panel. An indicator light (Red), labeled T/B OFF, is located adjacent to the indicator. The light provides the copilot with an indication of turn and bank operation.
   B. The turn and bank indicator is powered by 28 vdc through a 2 ampere circuit breaker.

2. Description
   A. The turn and bank indicator consists of an electrically driven gyroscopic rate of turn indicator and a fluid damped inclinometer. The turn indicator pointer, actuated by an electrically driven gyro, moves in the direction of a turn in an amount proportional to the rate of turn of 90° per minute. The relationship of the black ball in the inclinometer to the two wires at the center of the inclinometer indicates the lateral attitude of the aircraft.

3. Removal/Installation
   A. Remove Turn and Bank Indicator
      (1) Assure that Battery Switches and Stall Warning Switches are off.
      (2) Lower copilot's instrument panel.
      (3) Disconnect electrical plug from turn and bank indicator.
      (4) Loosen and remove attaching parts and indicator from panel.
   B. Install Turn and Bank Indicator
      (1) Install indicator and secure with attaching parts.
      (2) Connect electrical plug to indicator.
      (3) Raise and secure copilot's instrument panel.



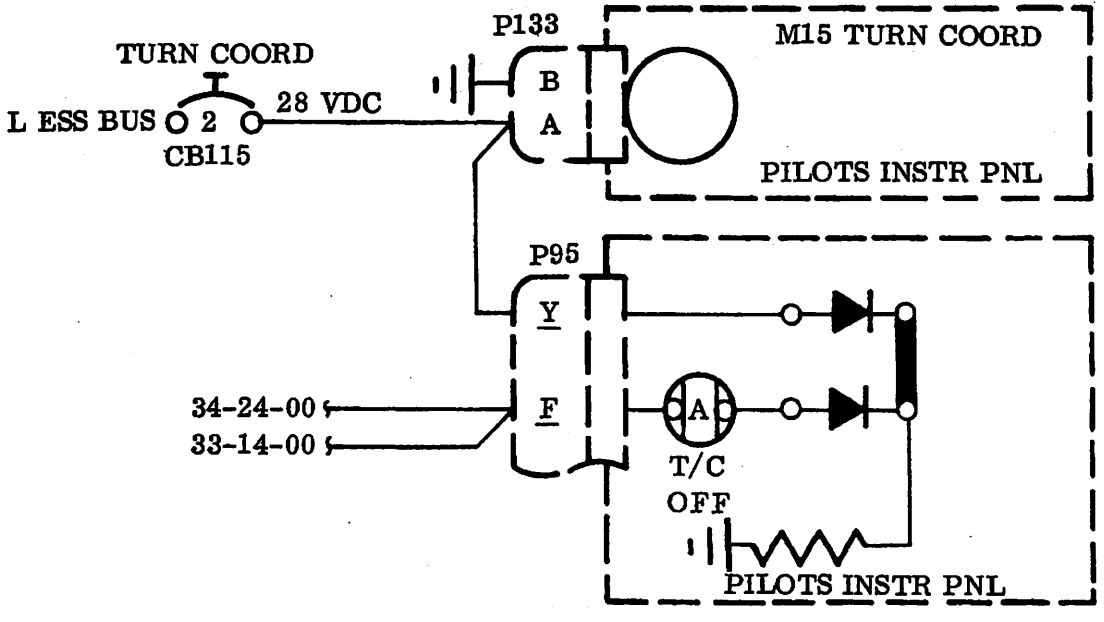
Turn and Bank Electrical Control Schematic
Figure 201

TURN COORDINATOR - MAINTENANCE PRACTICES

1. General
   A. The turn coordinator is installed in the pilot's instrument panel. An indicator light (red), labeled T/C OFF, is located adjacent to the coordinator. The light provides the pilot with a positive indication of turn coordinator operation.
   B. The turn coordinator is powered by 28 vdc through a 2 ampere circuit breaker.

2. Description
   A. The turn coordinator consists of an electrically driven gyroscopic roll-turn rate indicator and a fluid damped inclinometer. The turn indicator airplane, actuated by an electrically driven gyro, moves in the direction of a turn in an amount proportional to the rate of turn. The relationship of the white ball in the inclinometer to the white pointer at the center of the inclinometer indicates the lateral attitude of the aircraft.

3. Removal/Installation
   A. Remove Turn Coordinator
      (1) Assure that Battery Switches and Stall Warning Switches are off.
      (2) Lower pilot's instrument panel.
      (3) Disconnect electrical plug from indicator.
      (4) Loosen and remove attaching parts and indicator from panel.
   B. Install Turn Coordinator
      (1) Install indicator and secure with attaching parts.
      (2) Connect electrical plug to indicator.
      (3) Raise and secure pilot's panel.



Turn Coordinator Electrical Control Schematic
Figure 201

LANDING AND TAXIING AIDS - DESCRIPTION AND OPERATION

1. General
   A. The receivers for localizer, glideslope, marker beacon and also VOR/ILS are all combined into the navigation receivers.
   B. Selecting a localizer frequency automatically selects the paired glideslope channel.
   C. The volume control varies the level of audio signals to the audio control system for VOR/localizer and marker beacon reception.

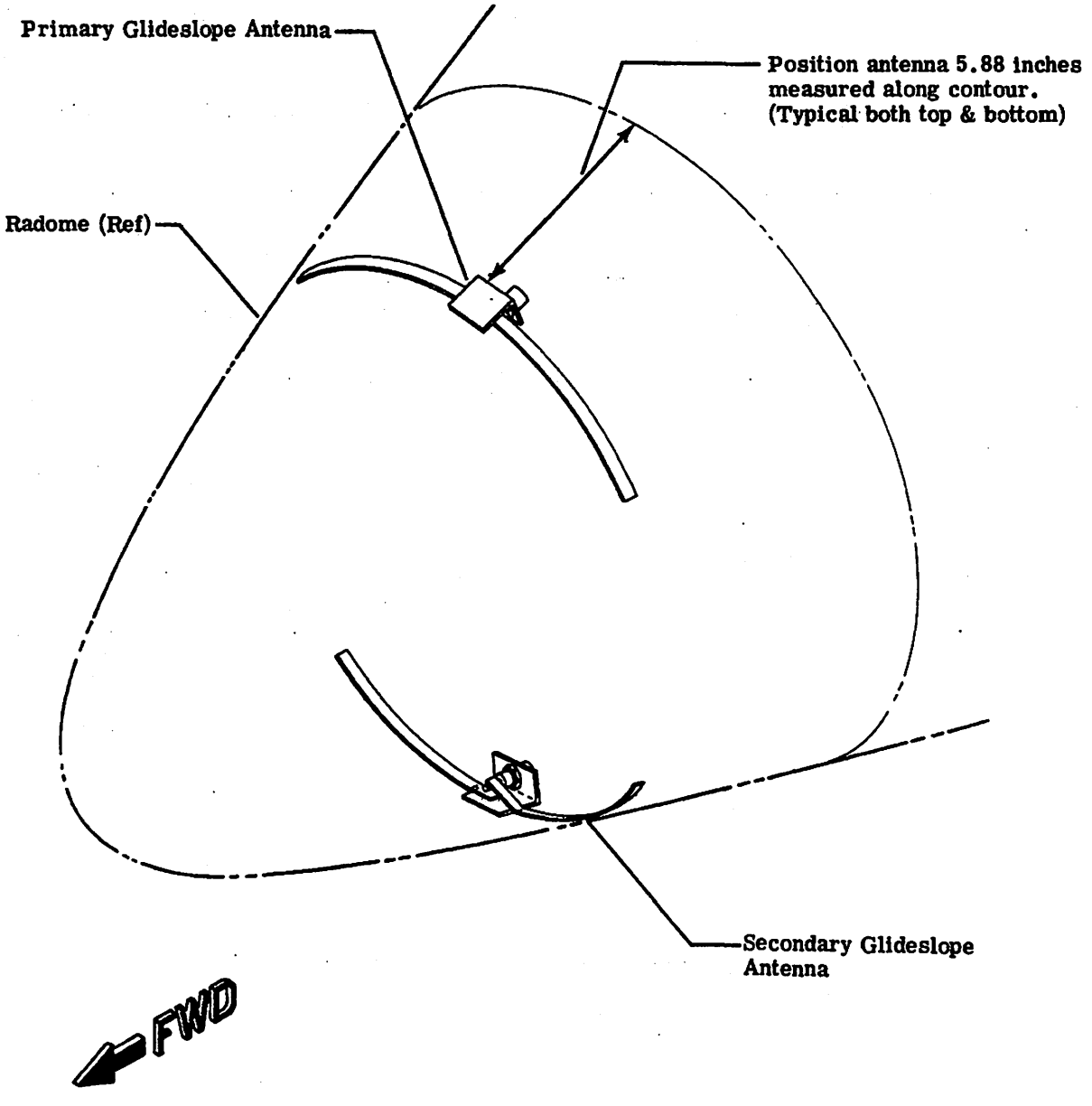
GLIDESLOPE ANTENNA - MAINTENANCE PRACTICES

1. General
   A. The primary and secondary glideslope antennas are installed in the radome.
   B. The primary glideslope antenna is installed in the upper portion of the radome. The secondary glideslope antenna is installed in the lower portion of the radome.

2. Tools and Equipment

NAME	NUMBER	MANUFACTURER	USE
Pressure Sensitive Tape	#898 (#46 Alternate)	Minnesota Mining & Mfg. Co.	Installation of Antenna
Cleaning Solvent	MEK	Commercially Available	Cleaning Radome

3. Removal/Installation
   A. Remove Antenna (See figure 201)
      (1) Remove nose compartment access doors.
      (2) Disconnect glideslope antenna leads.
      (3) Disconnect radome anti-ice alcohol line.
      (4) Remove screws and radome from aircraft.
      (5) Remove pressure sensitive tape and antenna from radome.
   B. Install Antenna (See figure 201)
      (1) Clean inner surface of radome where antenna was installed with MEK.
      (2) Position antenna on radome as shown.
      (3) Place strip of tape over lower element and mounting bracket.
      (4) Place second strip of tape over upper element.
      (5) Install radome and secure with attaching parts.
      (6) Connect glideslope antenna leads.
      (7) Connect radome anti-ice alcohol line.
      (8) Install nose compartment access doors.



Glideslope Antenna Installation
Figure 201

MARKER BEACON ANTENNA - MAINTENANCE PRACTICES

1. General
   A. The marker beacon antenna is installed beneath the aircraft just aft of the nose wheel doors (approximate F.S. 163.0).
   B. Access to the marker beacon antenna is gained by removing the nose gear strut.

2. Tools and Equipment

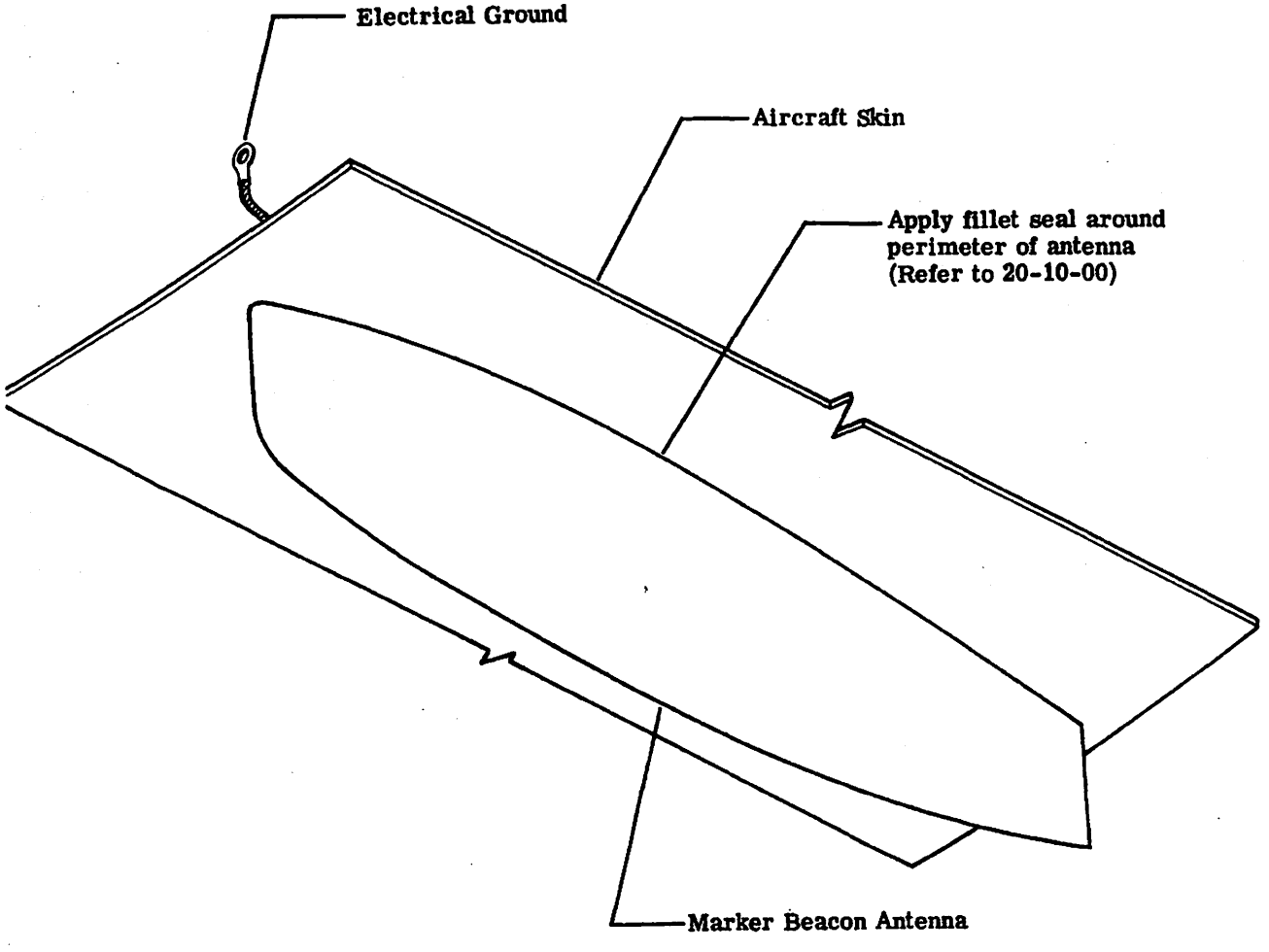
   NOTE: Equivalent substitutes may be used in lieu of the following:

NAME	NUMBER	MANUFACTURER	USE
Marker Beacon Test Generator	MBG-1	Dare Inc.	To provide test tones for Marker Beacon.

3. Removal/Installation
   A. Remove Marker Beacon Antenna (See figure 201)
      (1) Place the aircraft on jacks. (Refer to 7-00-01)
      (2) Remove nose gear strut. (Refer to 32-21-00)
      (3) Disconnect marker beacon antenna lead.
      (4) Disconnect electrical jumper leads.
      (5) Remove attaching parts and antenna and gasket from aircraft.
      (6) Remove old fillet seals from exterior surface of aircraft skin and interior surface where antenna receptacle protrudes through skin.
      (7) Clean surfaces with MEK.
   B. Install Marker Beacon Antenna (See figure 201)
      (1) Install gasket, antenna and secure with attaching parts.
      (2) Secure electrical jumpers to aircraft frame with attaching parts.
      (3) Apply fillet seal around entire external perimeter of antenna and around antenna receptacle on inside surface of aircraft.
      (4) Connect antenna lead to marker beacon.
      (5) Install nose gear strut. (Refer to 32-21-00)
      (6) Remove aircraft from jacks. (Refer to 7-00-01)

4. Inspection/Check
   A. Operational Check of Marker Beacon
      (1) Place MBG-1 directly beneath the Marker Beacon Antenna.
      (2) Extend MBG-1 whip antenna to its full length.
      (3) Set the generator for 10K microvolt output.
      (4) Set Battery Switches to ON. Allow 3 minutes warmup time.
      (5) Set MBG-1 power switch to ON, and adjust the modulation to 3 KHz @ 95%.

(6) Set Marker Beacon sensitivity switch to HI.
(7) A 3 KHz tone should be heard in the pilot's and copilot's headphones and speakers, and the white FM/Z marker lamps should be brightly lighted.
(8) Adjust MBG-1 modulation to 1.3 KHz @ 95%. A 1.3 KHz tone should be heard over the headsets and speakers and the MM marker lamps should be brightly lighted.
(9) Adjust MBG-1 to 400 Hz at 95%. A 400 Hz tone should be heard over the headsets and speakers and the OM marker lamps should be brightly lighted.
(10) Set Battery Switches OFF .
(11) Set MBG-1 power switch OFF.



Marker Beacon Antenna Installation
Figure 201

WEATHER RADAR - DESCRIPTION AND OPERATION

1. General
   A. The weather radar system is a lightweight, compact, solid-state, X-band airborne system designed for weather detection, ranging, and analysis. The overall system consists of the Receiver-Transmitter, Indicator and Antenna.

2. Description (RCA AVQ21 Weather Radar)
   A. Receiver-Transmitter
      (1) The Receiver-Transmitter is housed in a short 1/2 ATR case. The receiver-transmitter is installed in the nose compartment just forward of the nose wheel well.
      (2) The receiver-transmitter incorporates a blower for internal cooling. A push-pull switch labeled MOD ON PUSH/MOD OFF PULL is located on the front panel of the receiver-transmitter. After power has been applied, this switch permits maintenance personnel to disable the modulator and prevent the receiver-transmitter from transmitting. The modulator can be reactivated by pushing the push-pull switch. A means for calibrating the antenna roll and pitch stabilization amplifier to the aircraft stabilization source is available on the receiver-transmitter front panel. The pitch and roll adjustments are labeled PITCH GAIN and ROLL GAIN. All other electrical connections are made to two electrical connections on the front panel.
   B. Indicator
      (1) The radar indicator is located in the center instrument panel. All system operating controls, including the pushbutton-type, function-select switches, are grouped around the display on the instrument front panel.
      (2) The indicator uses a 5-inch display-storage cathode-ray tube designed for direct viewing under all lighting conditions. It presents an offset, plan-position, 120 degree sector display. Because of its high brightness and controlled persistence, the indicator never requires a viewing hood. A variable-density polarized filter on the front panel is used for attenuating the display brightness under conditions of low lighting. When the filter is adjusted for maximum attenuation, the display turns a deep subdued greenish-yellow color for night viewing.
   C. Antenna
      (1) The antenna is installed on frame 1 bulkhead.
      (2) The antenna, equipped with a flat-plate radiator, provides line-of-sight stabilization and is designed for a cantilever-type installation. All azimuth and elevation electro-mechanical drive components are located on the antenna frame. The stabilization amplifier is located in the receiver-transmitter. A switch on the

top side of the antenna adjacent to the connector allows azimuth scanning to be switched off or on as required by the maintenance personnel.

D. For further information on the weather radar system, refer to RCA AVQ-21 Weather Radar Instruction Manual; publication No. 1B8029017.

3. Description (Bendix RDR-1200 Weather Radar)

A. Receiver-Transmitter

(1) The receiver-transmitter is housed in a short 1/2 ATR case. The receiver-transmitter is located in the nose compartment just forward of the nose wheel well.

B. Indicator

(1) The radar indicator is located in the center instrument panel. The system controls are grouped below the radar screen on the front of the radar indicator.

(2) The indicator utilizes a high-contrast rectangular cathode ray tube with a 3.3x4.3 display area. The display is continuous with data update every few seconds.

C. Antenna

(1) The antenna is installed on the forward side of frame 1.

(2) The antenna will operate in ambient air pressures without pressurization.

WEATHER RADAR - MAINTENANCE PRACTICES

1. Tools/Equipment

NAME	NUMBER	MANUFACTURER	USE
Pitot and Static System Tester	MB-1	Aircraft Products Co. Bridgeport, Pa.	Pressurization Test of Receiver-Transmitter
Spirit Level		Commercially Available	
Tilt Table	TN26410	Gates Learjet	To rotate gyros
Patch Cable		Manufactured Locally	

2. Adjustment/Test
   A. Pressurization Test of Receiver-Transmitter
      (1) Remove nose compartment access doors.
      (2) Disconnect radar pressurization line at the forward side of frame 5.
      (3) Connect the pressurization line to the pressure side of the MB-1 tester.
      (4) Apply pressure to receiver-transmitter until MB-1 airspeed indicator reads 592 (±2) knots.
      (5) Close off system and allow to stand for 30 seconds. MB-1 airspeed indicator should not read less than 435 knots.
      (6) Disconnect pressurization line from MB-1 tester.

3. Inspection/Check
   A. Operational Check of RCA AVQ21 Weather Radar
      (1) Position the aircraft so that no large objects are within a 160° area scanned by the radar antenna.

      WARNING: TESTS INVOLVING RADIATION OF RF ENERGY BY THE RADAR ANTENNA MUST NOT BE MADE IN THE VICINITY OF REFLECTIVE STRUCTURES, REFUELING OPERATIONS OR WHEN PERSONNEL ARE STANDING DIRECTLY IN FRONT OF THE RADAR ANTENNA. RF ENERGY IS GENERATED IN ALL MODES EXCEPT STANDBY AND TEST. DO NOT ALLOW PERSONNEL WITHIN 15 FEET OF AREA BEING SCANNED BY ANTENNA.

(2) Level the aircraft. Refer to 8-00-00.
(3) Remove radome from aircraft. Refer to 53-50-00.
(4) Remove primary vertical gyro from aircraft. Refer to 34-22-00.
(5) Place vertical gyro on tilt table and connect to aircraft wiring with patch cable.
(6) Connect external power to aircraft.
(7) Set Battery Switches to BAT 1 and BAT 2 and Inverter Switches to PRI and SEC.
(8) Pull out Mode-Selection push-pull knob on the receiver transmitter.
(9) Set the indicator controls in the following positions:
  (a) Operation (Mode-Selection Push Button) - OFF
  (b) Gain Control (fully counterclockwise)
  (c) Trace - Mid-range
  (d) Range - 25 miles
  (e) Tilt Control - Zero degrees
  (f) Range Marks - Mid-range
  (g) Polarizing Filter Handle - Full left
(10) Assure that radar DC and AC circuit breakers are depressed.
(11) Pull vertical gyro circuit breaker.
(12) Depress STBY operation push button and allow 4 minutes warmup time.
(13) Set the Scan-Disable Switch on the antenna to the OFF (up) position.
(14) Depress the NORM push-button on the indicator.
(15) Place spirit level upright against front of antenna radiator. Antenna radiator should read zero degree tilt. Note any degree pitch.
(16) Turn tilt control alternately to 15° up and down.
(17) Observe spirit level and verify that antenna radiator responds in the proper direction to an amount equal to the aircraft pitch (if any) plus 15° (±1.5) degrees.
(18) Turn tilt control so that spirit level on antenna radiator indicates zero degree pitch.
(19) Assure that vertical gyro on tilt table is level in both the pitch and roll axis.
(20) Manually position antenna radiator to zero degree azimuth with respect to the aircraft.
(21) Depress vertical gyro circuit breaker.
(22) Alternately rotate the tilt table, in the pitch axis, 20° up and down.
(23) Verify that the antenna radiator pitches 20 (±1.5) degrees in the opposite direction.
(24) Adjust the pitch gain adjustment screw on the receiver-transmitter unit to compensate for any variations.
(25) Level tilt table in pitch and roll axis.
(26) Manually position the antenna radiator to 60° left of center.

(27) Check that spirit level indicates zero degree pitch.
(28) Rotate the vertical gyro 29° both right wing down and left wing down.
(29) Verify that antenna radiator moves between 25.5 to 27.5 degrees in the following manner:
  (a) With the vertical gyro in the left wing down position and the antenna radiator at 60° left azimuth, the antenna should move upward 25.5 to 27.5 degrees. At 60° right azimuth the antenna should move downward 25.5 to 27.5 degrees.
  (b) With the vertical gyro in the right wing down position and the antenna radiator at 60° left azimuth, the antenna should move downward 25.5 to 27.5 degrees. At 60° right azimuth the antenna should move upward 25.5 to 27.5 degrees.
(30) Level tilt table in pitch and roll axis.
(31) Depress the STBY operation push-button on the indicator.
(32) Remove spirit level from antenna radiator.
(33) Set the Scan-Disable Switch to the down position.
(34) Pull vertical gyro circuit breaker.
(35) Disconnect patch cable from vertical gyro and install gyro in aircraft. Refer to 34-22-00.
(36) Install radome. Refer to 53-50-00.
(37) Set Battery Switches and Inverter Switches to OFF.

B. System Adjustments
  (1) Refer to applicable section in RCA, AVQ-21 Weather Radar. Instruction Manual; publication number 1B8029017, for complete adjustment procedures.

C. Operational Check of Bendix RDR-1200 Weather Radar

WARNING: TESTS INVOLVING RADIATION OF RF ENERGY BY THE RADAR ANTENNA MUST NOT BE MADE IN THE VICINITY OF REFLECTIVE STRUCTURES, REFUELING OPERATIONS OR WHEN PERSONNEL ARE STANDING DIRECTLY IN FRONT OF THE RADAR ANTENNA. RF ENERGY IS GENERATED IN ALL MODES EXCEPT STANDBY AND TEST. DO NOT ALLOW PERSONNEL WITHIN 15 FEET OF AREA BEING SCANNED BY ANTENNA.

(1) Position the aircraft so that no large objects are within a 120° area scanned by the radar antenna.
(2) Remove radome from the aircraft. Refer to 53-50-00.
(3) Manually rotate the antenna in tilt and azimuth axis to insure freedom of movement.
(4) Remove primary vertical gyro from aircraft. Refer to 34-22-00.
(5) Place vertical gyro on tilt table and connect to aircraft wiring with patch cable.

(6) Connect external power to the aircraft.
(7) Set Battery Switches to BAT 1 and BAT 2 and Inverter Switches to PRI and SEC.
(8) Assure that radar and primary vertical gyro circuit breakers are depressed.
(9) Set the range selector switch on the radar indicator to STBY and wait approximately one minute for system warmup.
(10) Set mode selector to WX position and turn range selector to TEST position. Check that the fault lamp on the radar panel is illuminated.
(11) Set scan selector to 120° STAB ON position. Check that the antenna drive assembly scans 120° azimuth range.
(12) Set scan selector to HOLD STAB ON position. Check that the antenna continues to scan. Return scan selector to 120° on position.
(13) Set range selector to STBY position.
(14) Set tilt control to +5°, +10° and +15°. Check that the antenna radiator tilts upward smoothly, and without interference.
(15) Set the tilt control to -5°, -10° and -15°. Check that the antenna radiator tilts down smoothly and without interference.
(16) Set the tilt control to 0°.
(17) Set range selector to TEST. Adjust brightness control for comfortable viewing level and observe the test pattern on the radar indicator.
    (a) There should be five equally spaced range marks with the last mark within approximately 1/8 inch of the edge of the indicator screen.
    (b) There should be no extraneous noise appearing on the display.
    (c) There should be two distinct levels of brightness with a dark (contour) band between the two areas of highest brightness.
(18) The update line should move across the screen fully, indicating the antenna is scanning the full 120°.
(19) Depress the WX pushbutton, elevate display, then release the pushbutton. While the pushbutton is being depressed, the dark (contour) band should disappear and the brightest shade should appear in its place.
(20) Set the range selector to 60° STAB ON position. The test pattern should remain unchanged except for the smaller azimuth angle.
(21) Set the Scan selector to HOLD. The update line should disappear and the test pattern should remain. Return Scan selector to 120° STAB ON position.
(22) Set range selector to STBY.
(23) Set vertical gyro to 0° pitch and 0° roll.
(24) Set the tilt control on the radar indicator to the zero position. Check that the antenna elevation position is 0° (±1°).

(25) Set the tilt control to +10°. Check that the antenna elevation is 10° (±1.5°).
(26) Set the tilt control to -10°. Check that the antenna elevation is -10° (±1.5°).
(27) Manually position the antenna to zero degrees in azimuth and insert a retaining pin into the 0° slot to lock the antenna.
(28) Adjust the tilt control on the radar indicator to exactly 0° in elevation.
(29) Position the vertical gyro to 10° nose up and zero degrees roll. The antenna elevation position should be 10° (±1.5°) down.
(30) Position the vertical gyro to 10° nose down and zero degrees roll. The antenna elevation position should be 10° (±1.5°) up.
(31) Position vertical gyro to level in pitch and roll and remove the retaining pin.
(32) Manually position the antenna to 60° right and lock the azimuth drive by inserting the retaining pin into the 60° CW slot.
(33) Position the vertical gyro to 0° pitch and 30° right roll. The antenna elevation should be 26° (±1.5°) up.
(34) Position the vertical gyro to 0° pitch and 30° left roll. The antenna elevation should be 26° (±1.5°) down.
(35) Position the vertical gyro to 0° pitch and roll and remove retaining pin.
(36) Set the Scan selector to 60° STAB OFF position. The antenna will level in pitch and roll.
(37) Set range selector to TEST.
(38) Check position of aircraft vertical gyro. Note the antenna scans 60° sector and remains fixed in pitch and roll.
(39) Set Scan selector to 120° STAB ON position and range selector to STBY.
(40) Place range selector to a convenient range position (after being in STBY or TEST at least one minute). Fault lamp should go out.
(41) Set the Scan selector to 120° STAB ON position.
(42) Check for target reflections of local weather (using range and tilt controls).
(43) Set Mode selector to GAIN position and check for conventional radar returns.
(44) Disconnect patch cable from vertical gyro and install gyro in aircraft. Refer to 34-22-00.
(45) Install radome. Refer to 53-50-00.
(46) Set Battery Switches and Inverter Switches to OFF.

D. System Adjustment
(1) For further information on the Bendix RDR-1200 Weather Radar System, refer to Installation Manual, publication number 1.B.21200.

RECEIVER-TRANSMITTER - MAINTENANCE PRACTICES

1. General
   A. The receiver-transmitter is installed in the nose compartment forward of the nose wheel well. The receiver-transmitter is secured to the mounting panel by two hold-down clamps.
   B. Maintenance practices consist of removal of defective component and installation of a new unit.

2. Removal/Installation
   A. Remove Receiver-Transmitter
      (1) Remove nose compartment access doors.
      (2) Disconnect waveguide from receiver-transmitter.
      (3) Cap exposed end of waveguide.
      (4) Disconnect electrical plugs from receiver-transmitter.
      (5) Loosen hold-down clamps and remove receiver-transmitter.
   B. Install Receiver-Transmitter
      (1) Install receiver-transmitter and secure hold-down clamps.
      (2) Connect electrical plugs to receiver-transmitter.
      (3) Connect waveguide to receiver-transmitter.
      (4) Install nose compartment access doors.

ANTENNA - MAINTENANCE PRACTICES

1. General
   A. Maintenance practices consist of removal of defective unit and installation of new unit.
   B. The antenna is installed on the forward side of frame 1. Access to the antenna is gained by removing the radome.

2. Removal/Installation
   A. Remove Antenna
      (1) Remove nose compartment access doors.
      (2) Disconnect coax lead from secondary glideslope antenna.
      (3) Remove radome. (Refer to 53-50-00)
      (4) Disconnect waveguide from antenna.
      (5) Cap exposed waveguide.
      (6) Disconnect electrical plug from antenna.
      (7) Remove attaching parts and antenna from aircraft.
   B. Install Antenna
      (1) Install antenna and secure with attaching parts.
      (2) Connect electrical plug to antenna.
      (3) Connect waveguide to antenna.
      (4) Install radome and secure with attaching parts.
      (5) Connect coax lead to secondary glideslope antenna.
      (6) Install nose compartment access doors.

RADAR INDICATOR - MAINTENANCE PRACTICES

1. General
   A. The RCA radar indicator is located on the center instrument panel. The indicator incorporates a receptacle which mates with a plug on the indicator mounting rack. The mounting rack incorporates guide pins which aid in aligning the receptacle and plug when installing the indicator. The indicator is secured in place by a clamp located approximately halfway back on the indicator.
   B. The Bendix radar indicator is located in the center instrument panel. The indicator is secured in place by two locking pawls on the bottom front of the indicator and two spring-loaded pins on the rear of the indicator. Electrical connections are made by a plug at the rear of the indicator. A clamp is also installed approximately halfway back on the indicator.

2. Removal/Installation
   A. Remove RCA AVQ-21 Radar Indicator
      (1) Assure that Battery and Stall Warning Switches are OFF.
      (2) Lower pilot's instrument panel.
      (3) Loosen clamp assembly securing indicator in mounting rack.
      (4) Loosen screws and remove small triangular clips in upper corners.
      (5) Pull indicator from panel.
   B. Install RCA AVQ-21 Radar Indicator
      (1) Install indicator in panel and secure in place with clamp assembly.
      (2) Install small triangular clips and secure with screws.
      (3) Raise pilot's instrument panel.
   C. Remove Bendix RDR-1200 Radar Indicator
      (1) Assure that Battery and Stall Warning Switches are OFF.
      (2) Lower pilot's instrument panel.
      (3) Loosen clamp assembly securing indicator in mounting rack.
      (4) Using a screwdriver disengage the locking pawls.

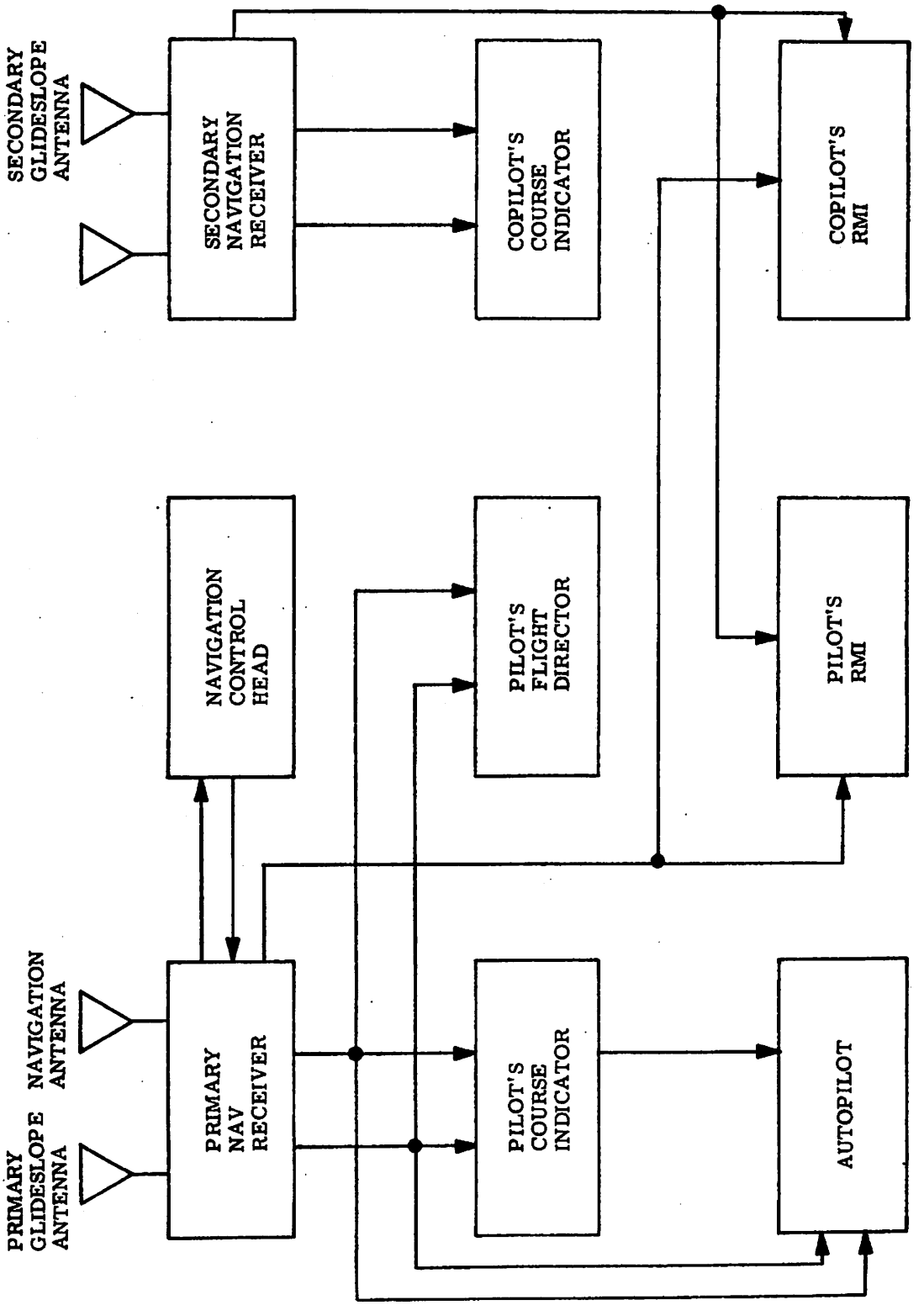
      NOTE: Clockwise rotation engages locking pawls, counterclockwise rotation disengages locking pawls.

      (5) Disconnect electrical plug from indicator.
      (6) Pull indicator from panel.
   D. Install Bendix RDR-1200 Radar Indicator
      (1) Install indicator in panel and engage the locking pawls.
      (2) Secure clamp assembly in place.
      (3) Connect electrical plug to indicator.
      (4) Raise pilot's instrument panel.

NAVIGATION - DESCRIPTION AND OPERATION

1. General
   A. The navigation-receiver receives and processes VOR, localizer, glideslope and marker beacon signals to provide VOR deviation, VOR to/from indication, localizer deviation, localizer audio, glideslope deviation, high-and-low level flag signals, and marker beacon lamp signals.
      (1) Two navigation receivers (primary and secondary) are installed in the nose compartment.
   B. The navigation balanced loop antenna consists of two half loop antennas, installed on each side of the vertical stabilizer. Each half is interconnected by coaxial tees.

2. Description
   A. The navigation receivers are designated as NAV 1 for the pilot and NAV 2 for the copilot.
      (1) NAV 1 provides VOR/LOC and G/S information for the pilot's flight director indicator and course indicator. This same information is provided for the autopilot computer (22-00-00). VOR bearing information is also available to both RMI's.
      (2) NAV 2 provides VOR/LOC and G/S information for the copilot's flight director. This same information is provided for the autopilot computer (22-00-00). VOR bearing information is also available to both RMI's.
   B. Both navigation receivers are connected to the DME to control DME frequency. A switch on the DME distance ground speed indicator selects whether NAV 1 or NAV 2 is to be the controlling unit. Selecting either a VOR or localizer frequency on selected NAV, tunes the DME to the correct frequency for that channel.
   C. A signal is directed to the audio control system when a VOR or localizer signal is being received. Volume is controlled by the volume control in the audio control panel.



Navigation Receiver Block Diagram
Figure 1

NAVIGATION RECEIVERS - MAINTENANCE PRACTICES

1. General

A. The navigation receivers are enclosed in a 3/8 ATR short, low case. All electrical connections are made at the rear of the case when installed.

2. Removal/Installation

NOTE: Removal and installation procedures are identical for both receivers.

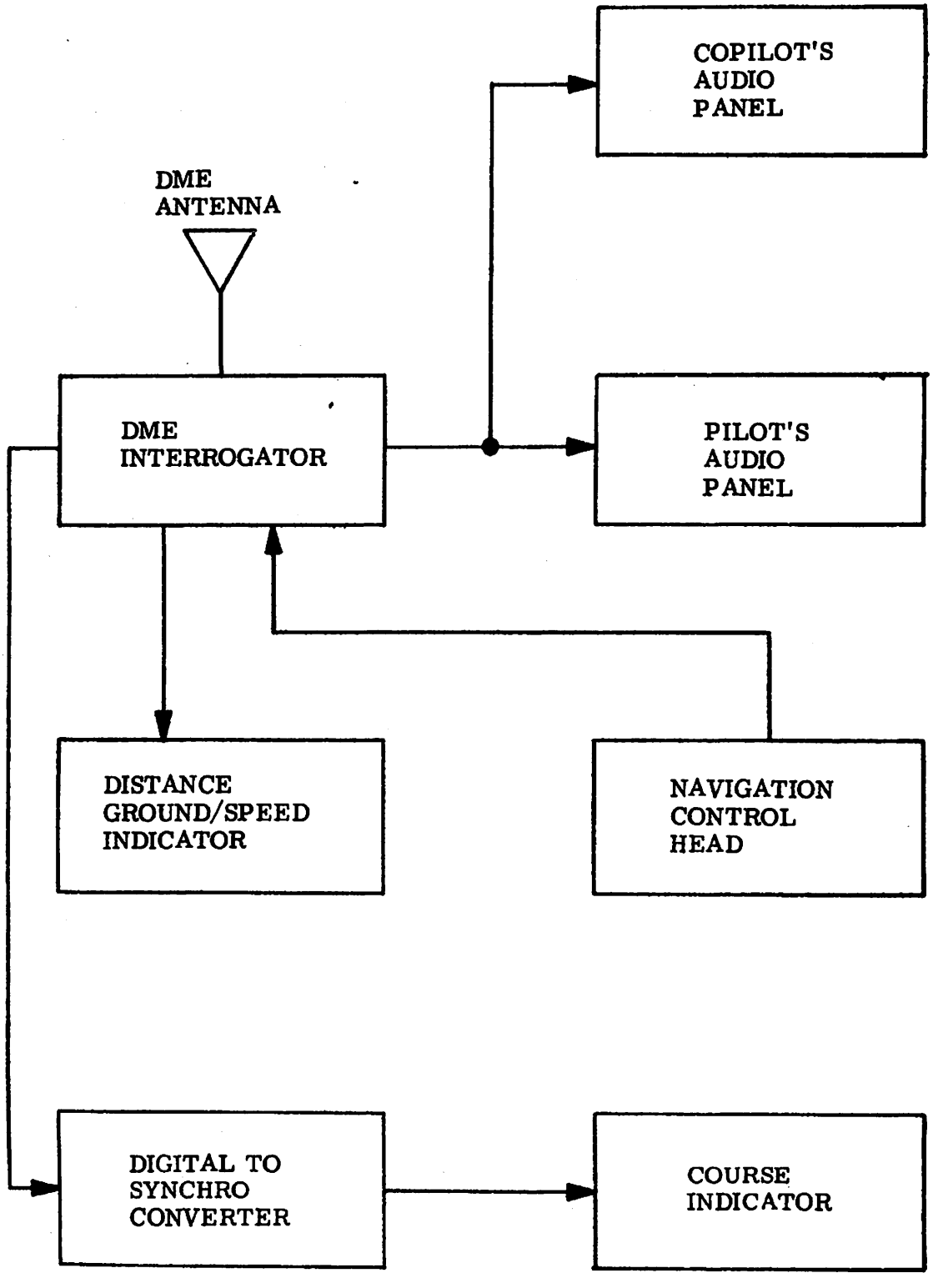
A. Remove Navigation Receiver
   (1) Remove nose compartment access doors.
   (2) Disconnect electrical plug and antenna leads.
   (3) Loosen navigation receiver hold-down clamps and remove receiver from mounting rack.

B. Install Navigation Receiver
   (1) Install navigation receiver in mounting rack and secure hold-down clamps.
   (2) Connect electrical plug and antenna lead.
   (3) Install nose compartment access doors.

DME - DESCRIPTION AND OPERATION

1. General
   A. The DME system is an airborne four-in-one avionics system (transmitter, receiver, computer and display) that continuously measures the slant range between the aircraft and a ground station and displays this information to the pilot in terms of nautical miles.
   B. The DME system consists of the interrogator, distance ground/speed indicator, digital to synchro converter and DME antenna.
      (1) The interrogator and mounting rack are installed on the RH side of the baggage compartment floor. All electrical connections are made to the front face of the interrogator.
      (2) The converter is installed under the divan seat on the aircraft centerline.
      (3) The indicator is installed on the copilot's instrument panel.
      (4) The antenna is installed beneath the aircraft at F.S. 240.39.

2. Operation
   A. The center of the DME system is the interrogator which functions remotely with respect to the control unit and indicator. The DME frequency channel is automatically selected for the DME when the navigation receiver is tuned to the co-located VOR station. The DME transmits interrogation pulse pairs on the ground station's receiving frequency and the ground station returns coded reply pulse pairs on its transmitting frequency. The reply signals, picked up by the transmit-receive DME antenna on the aircraft, are fed to the interrogator for amplification, verification and distance measurement. By computing elapsed time between transmission of the interrogation signals and receipt of the reply signals, the interrogator determines the linear distance between the airplane and the ground station.
   B. The digital-to-synchro converter receives distance information from the interrogator in the form of a gated clock pulse train and converts it to synchro signals which are used to drive the synchro distance indicator.



DME Block Diagram
Figure 1

INTERROGATOR - MAINTENANCE PRACTICES

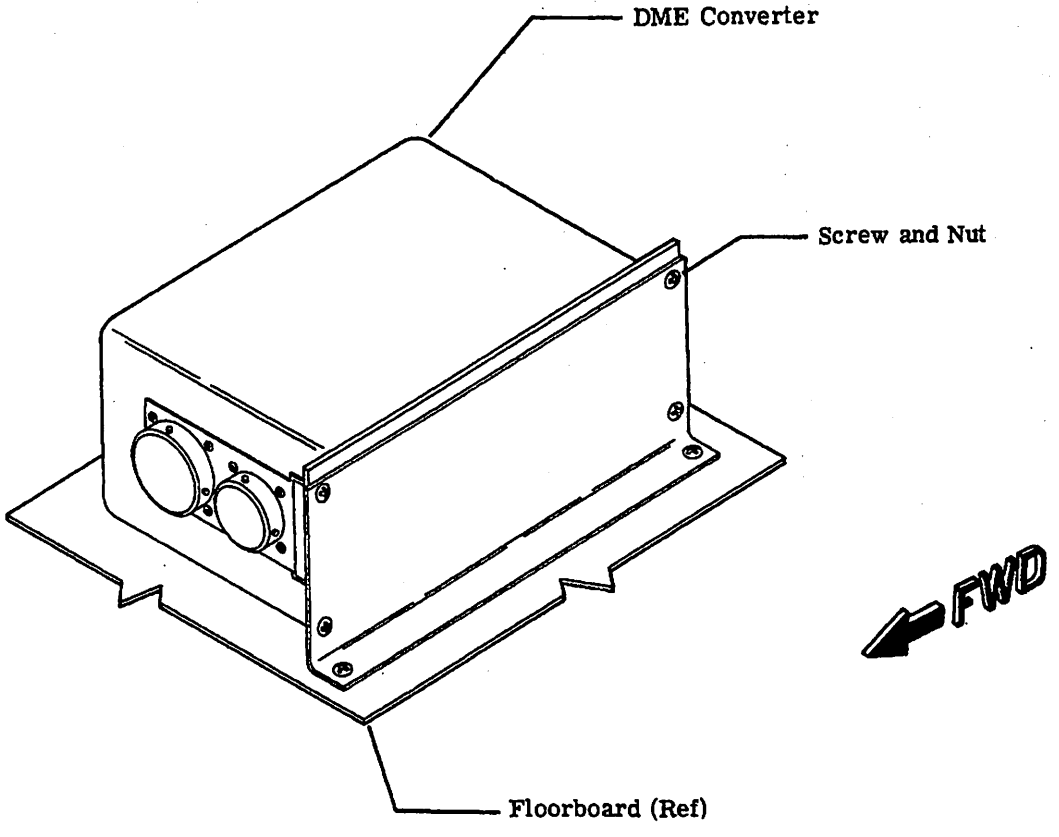
1. General
   A. The interrogator and mounting rack are located on the baggage compartment floor or on the RH side of the tailcone between frames 27 and 28.
   B. Maintenance practices consist of replacement of defective component.

2. Removal/Installation
   A. Remove Interrogator
      (1) Disconnect electrical connectors and antenna lead from interrogator.
      (2) Loosen hold-down clamps and remove interrogator from mounting rack.
   B. Install Interrogator
      (1) Install interrogator in mounting rack and secure hold-down clamps.
      (2) Connect electrical connectors and antenna lead.

DME CONVERTER - MAINTENANCE PRACTICES

1. General
   A. The DME converter is installed beneath the divan seat on the aircraft centerline or in the RH side of the tailcone adjacent to the interrogator. The converter is secured to a mounting bracket.
   B. Maintenance practices consist of replacement of defective component.

2. Removal/Installation
   A. Remove Converter (See figure 201)
      (1) Remove divan seat.
      (2) Disconnect electrical connectors from converter.
      (3) Remove attaching screws and converter from mounting bracket.
   B. Install Converter (See figure 201)
      (1) Install converter on mounting bracket and secure with attaching screws.
      (2) Connect electrical connectors to converter.
      (3) Install divan seat.

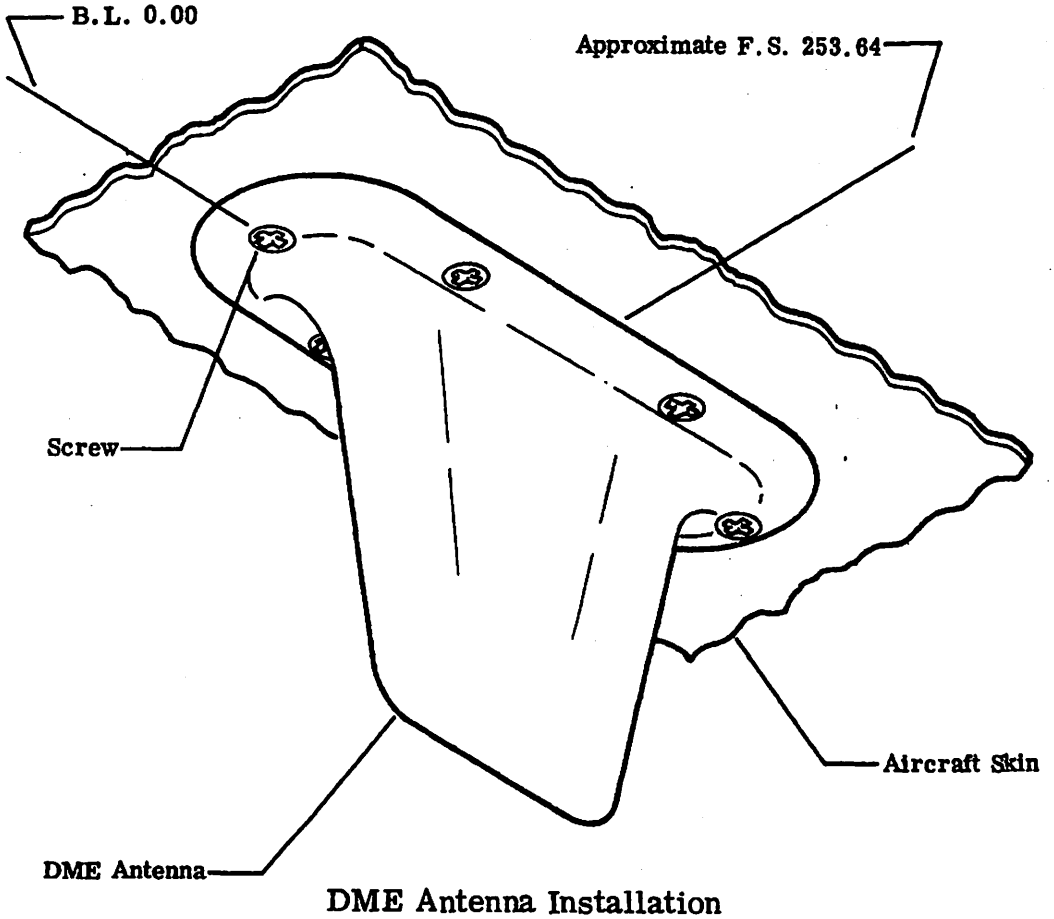


DME Converter Installation
Figure 201

DME ANTENNA - MAINTENANCE PRACTICES

1. General
   A. The DME antenna is installed beneath the aircraft at approximately F.S. 253.64. The antenna is secured to aircraft structure by screws.
   B. Maintenance practices consist of replacement of defective component.

2. Removal/Installation
   A. Remove Antenna (See figure 201)
      (1) Remove carpet and floorboards as necessary to gain access to antenna installation.
      (2) Disconnect antenna lead from antenna.
      (3) Remove attaching screws and antenna from aircraft.
   B. Install Antenna (See figure 201)
      (1) Install gasket and antenna on aircraft and secure with attaching screws.
      (2) Connect antenna lead to antenna.
      (3) Install floorboards and carpet.



DME Antenna Installation
Figure 201

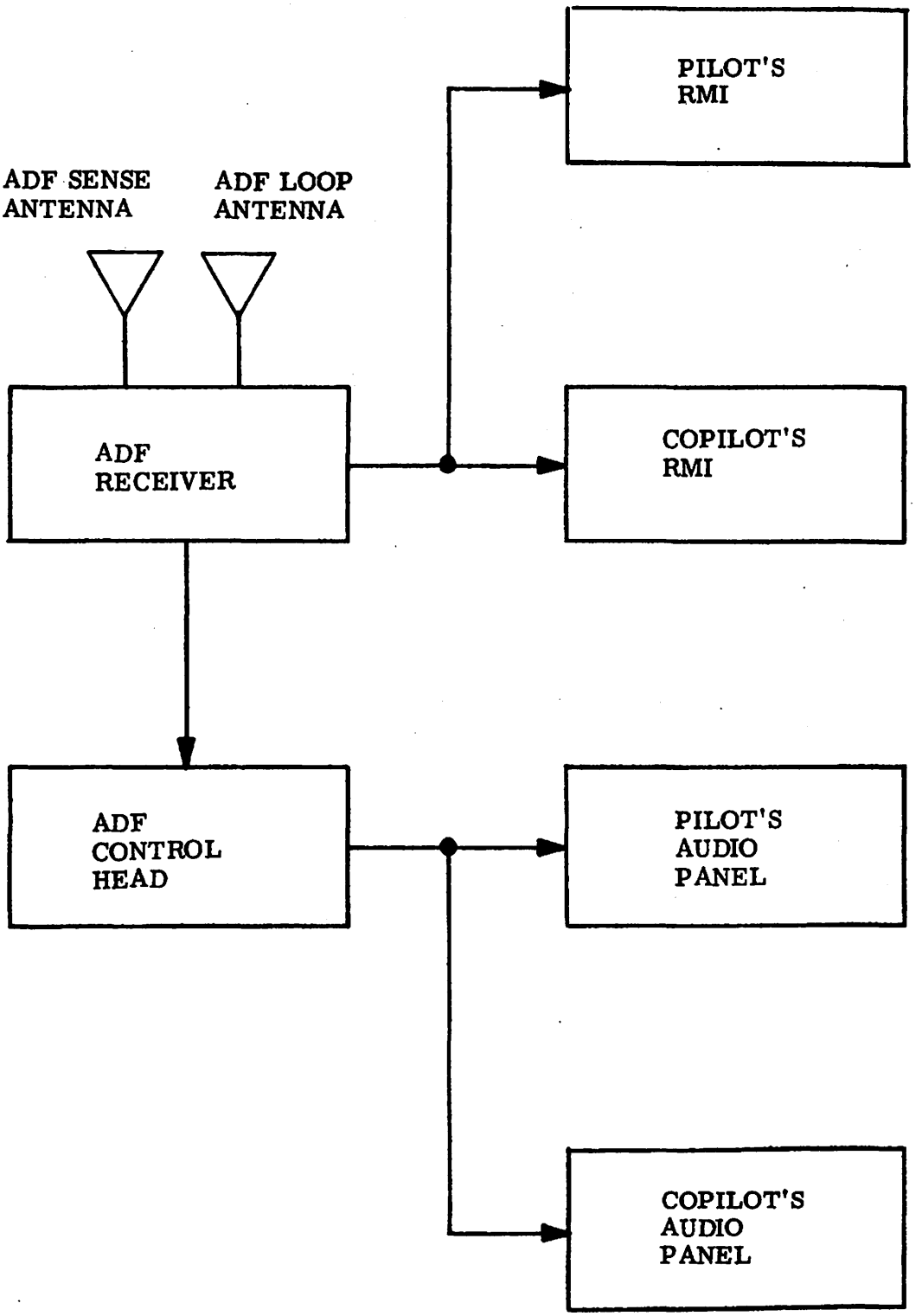
DISTANCE GROUND SPEED INDICATOR - MAINTENANCE PRACTICES

1. General
   A. The distance-ground speed indicator is located on the copilot's instrument panel. The indicator is secured by an instrument clamp.
   B. Maintenance practices consist of replacement of defective component.

2. Removal/Installation
   A. Remove Indicator
      (1) Set Battery Switches to OFF and Stall Warning Switches to OFF position.
      (2) Lower copilot's instrument panel.
      (3) Disconnect electrical connector from indicator.
      (4) Loosen instrument clamp screws and remove indicator from instrument panel.
   B. Install Indicator
      (1) Install indicator on instrument panel and secure instrument clamp.
      (2) Connect electrical connector to indicator.
      (3) Raise copilot's instrument panel and secure.

ADF - DESCRIPTION AND OPERATION

1. General
   A. The automatic direction finder (ADF) system is a navigational aid which provides the crew with continuous relative bearing readings to low-frequency homing stations, radio beacon and broadcast stations.
   B. In the ADF mode of operation the receiver processes the selected radio signal from the loop and sense antennas into relative bearing information for use by the indicator and the RMI's. In ANT mode, the receiver functions as a conventional IF and broadcast band receiver.



ADF Block Diagram
Figure 1

ADF RECEIVER - MAINTENANCE PRACTICES

1. General
   A. The ADF receiver is installed in the nose compartment on the LH side of the nose wheel well box. The receiver is mounted in a rack which incorporates a plug in type connector.
   B. Maintenance practices consist of replacement of defective component.

2. Removal/Installation
   A. Remove ADF Receiver
      (1) Remove nose compartment access doors.
      (2) Disconnect antenna leads from receiver.
      (3) Loosen and disengage receiver hold-down screw.
      (4) Remove receiver from aircraft.
   B. Install ADF Receiver
      (1) Install receiver and secure with hold-down screw.
      (2) Connect antenna leads to receiver.
      (3) Install nose compartment access doors.

ADF CONTROL HEAD - MAINTENANCE PRACTICES

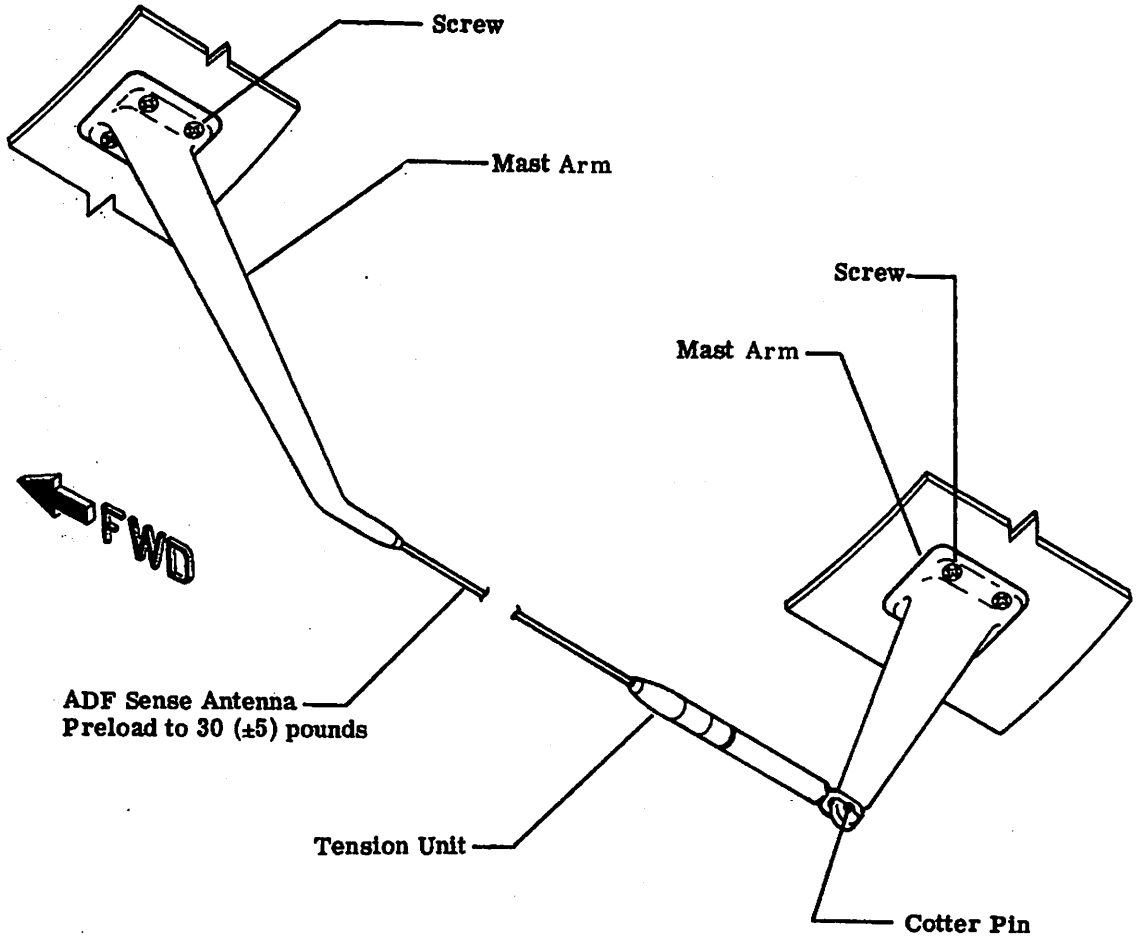
1. General
   A. The ADF control head is installed in the center instrument panel. The control head is secured by quick-release fasteners.
   B. The control head incorporates all control switches for the ADF system.

2. Removal/Installation
   A. Remove Control Head
      (1) Loosen quick-release fasteners.
      (2) Remove control head sufficiently to gain access to electrical plug.
      (3) Disconnect electrical plug and remove control head from pedestal.
   B. Install Control Head
      (1) Connect electrical plug to control head.
      (2) Position control head in pedestal and secure with attaching parts.

ADF SENSE ANTENNA - MAINTENANCE PRACTICES

1. General
   A. The ADF sense antenna is installed beneath the aircraft from approximate F.S. 142.00 to F.S. 350.0.

2. Removal/Installation
   A. Remove Sense Antenna (See figure 201)
      (1) Remove nose compartment access doors.
      (2) Loosen screws securing aft mast arm to fuselage.
      (3) Remove cotter pin and end of antenna from aft mast arm.
      (4) Remove screws and aft mast arm from aircraft.
      (5) Disconnect antenna lead from forward mast arm.
      (6) Remove attaching parts and forward mast arm from aircraft.
   B. Install Sense Antenna (See figure 201)
      (1) Install forward mast arm and secure with attaching parts.
      (2) Connect antenna lead to forward mast arm.
      (3) Install aft mast arm and secure with attaching parts.
      (4) Install antenna on mast arm and install cotter pin.

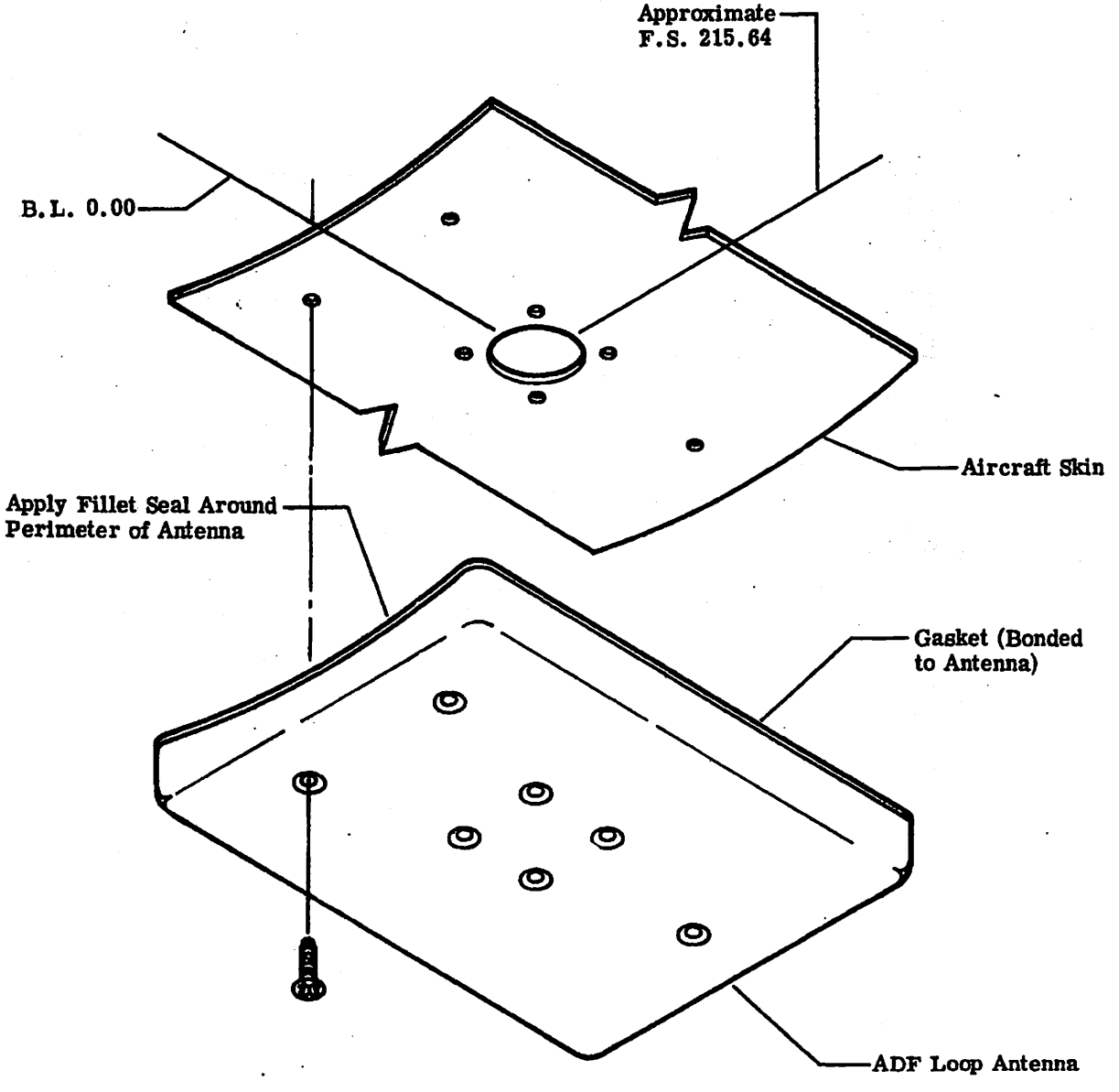


ADF Sense Antenna Installation
Figure 201

ADF LOOP ANTENNA - MAINTENANCE PRACTICES

1. General
   A. The ADF loop antenna is located beneath the aircraft at approximate F.S. 215.64.

2. Removal/Installation
   A. Remove Loop Antenna (See figure 201)
      (1) Remove carpet and floorboards to gain access to loop antenna installation.
      (2) Disconnect loop antenna lead.
      (3) Remove screws and loop antenna from aircraft.
   B. Install Loop Antenna (See figure 201)
      (1) Install loop antenna and secure with attaching parts.
      (2) Connect antenna lead.
      (3) Install floorboards and carpet.
      (4) Apply a fillet seal around perimeter of antenna. (Refer to 21-10-00)

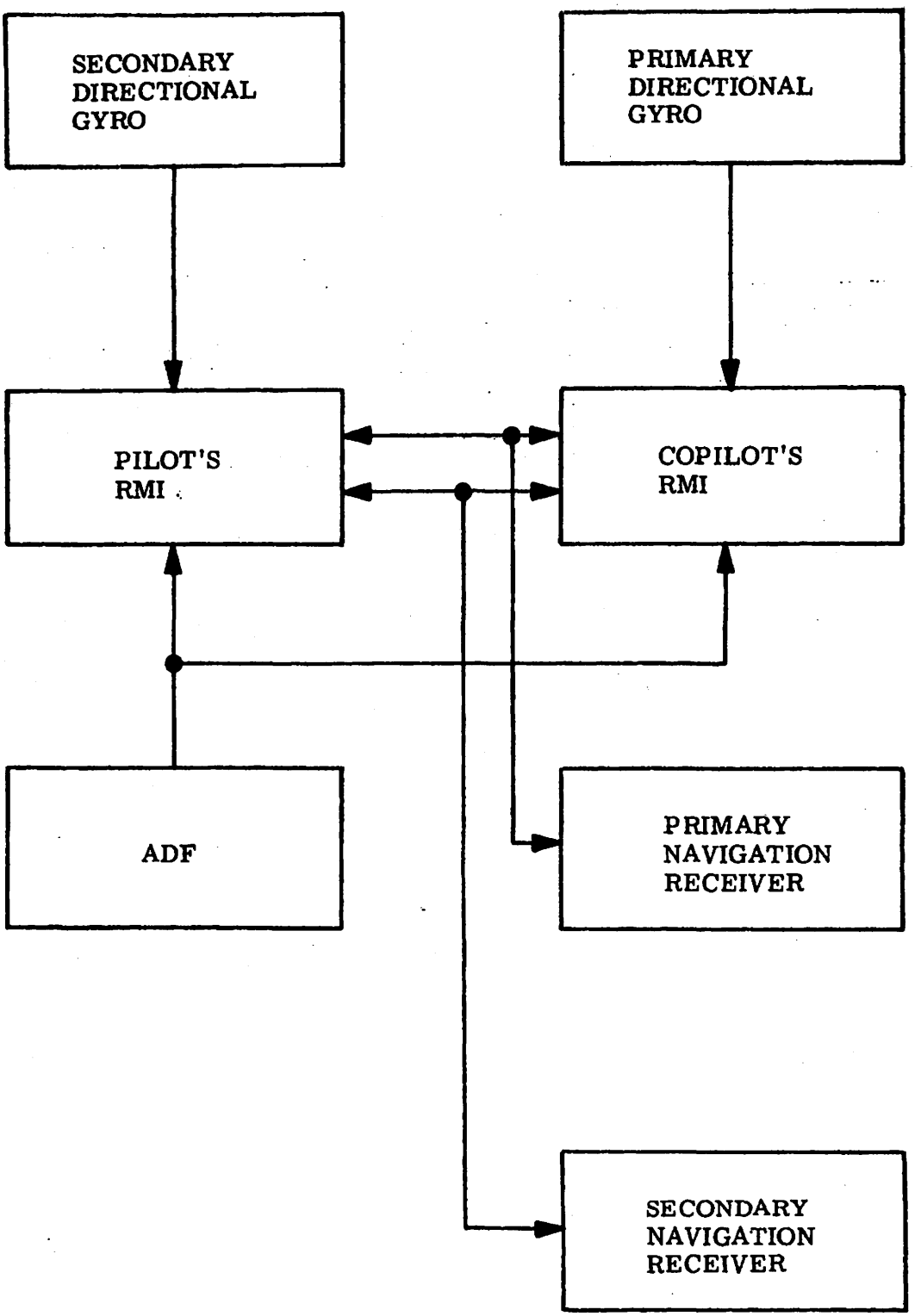


ADF Fixed Loop Antenna Installation
Figure 201

RADIO MAGNETIC INDICATOR - DESCRIPTION AND OPERATION

1. General
   A. Two radio magnetic indicators are installed: one on the pilot's instrument panel and one on the copilot's instrument panel.
   B. The RMI's display aircraft heading by a rotating compass card. They also display VOR and ADF bearing information, both relative and magnetic.

2. Operation
   A. The RMI's receive heading information from the primary and secondary directional gyros and the primary and secondary navigation receivers. The pilot's RMI utilizes the primary systems and the copilot utilizes the secondary systems.



RMI Block Diagram
Figure 1

RADIO MAGNETIC INDICATOR - MAINTENANCE PRACTICES

1. General
   A. Maintenance practices consist of replacing the defective component.

2. Removal/Installation

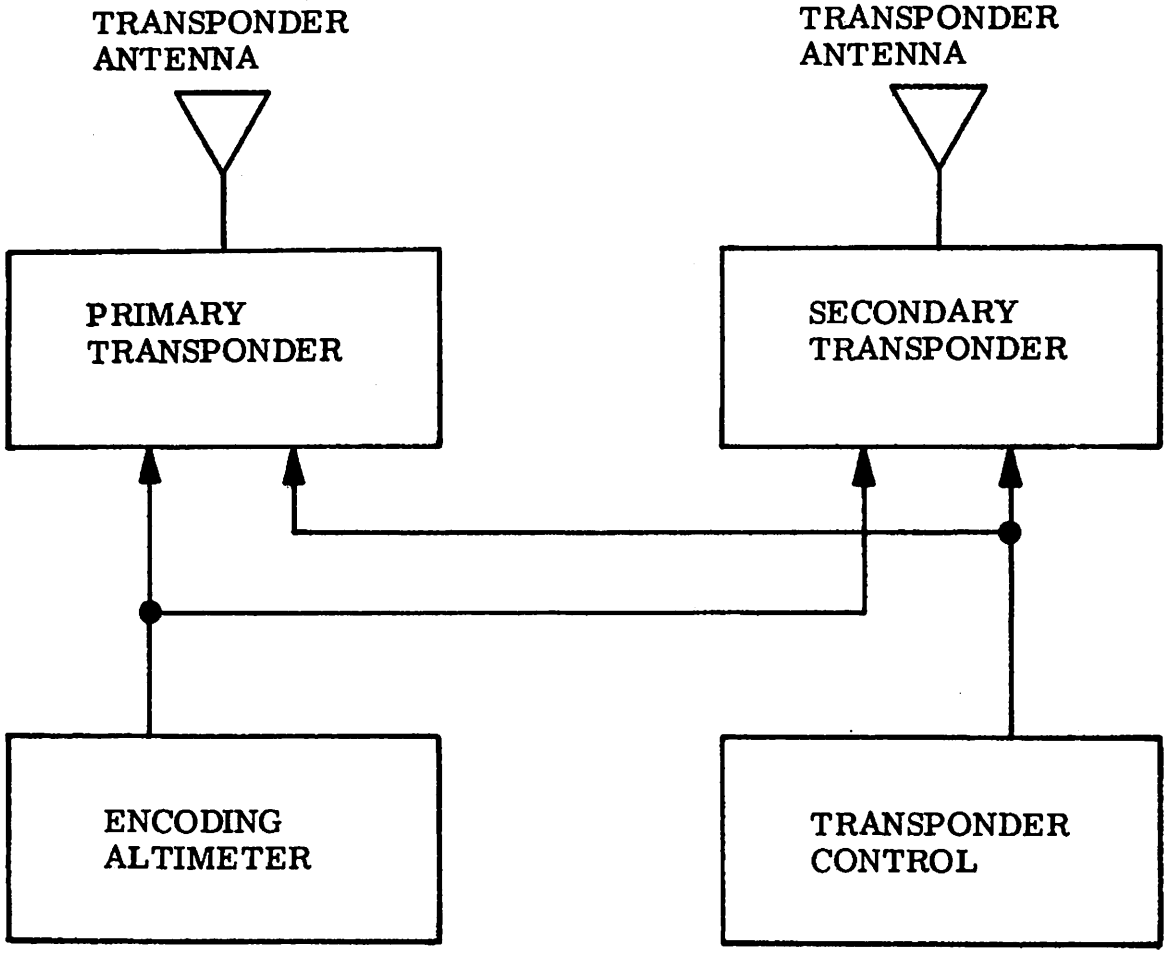
   NOTE: Removal and Installation procedures for both RMI's are identical.

   A. Remove RMI
      (1) Assure that Battery and Stall Warning Switches are OFF.
      (2) Lower applicable instrument panel.
      (3) Disconnect electrical plug from RMI.
      (4) Loosen instrument clamp screws and remove RMI from panel.
   B. Install RMI
      (1) Position RMI in instrument panel.
      (2) Secure instrument clamp and RMI.
      (3) Raise instrument panel and secure.

ATC TRANSPONDER - DESCRIPTION AND OPERATION

1. General
   A. The transponder installation consists of either single or dual transponders which are installed either in the nose compartment, under the aft divan seat or in the tailcone equipment section.
   B. The control head is installed in the center instrument panel.
   C. Two ATC transponder antennas are installed. One is located at Sta. 341.13 (Pri) and one at Sta. 314.26 (Sec) along the lower aircraft centerline. Access to the antennas is gained through the floorboards.

2. Description
   A. The transponder system enables identification interrogators to identify the aircraft or ground Air Surveillance Radar (ASR) with interrogators, to both see and identify the aircraft at ranges beyond normal radar range. In addition, altitude reporting information is furnished to the identification interrogators. The transponder is housed in a short 1/4 ATR case. All electrical connections are made at the case front panel.
   B. The control head is a switching and indicator unit for control of power, test, monitor, code, identification and mode functions of the transponder.



ATC Transponder Block Diagram
Figure 1

ATC TRANSPONDER - MAINTENANCE PRACTICES

1. General
   A. Maintenance practices consist of replacement of defective component.

2. Removal/Installation

   NOTE: The upper transponder (Secondary) is secured to the lower transponder (Primary) by screws through the handle of the unit.

   A. Remove Transponder Case
      (1) Disconnect electrical plugs from transponders.
      (2) Loosen hold-down clamp and remove transponders from transponder rack.
   B. Install Transponder
      (1) Position transponders in rack and secure with hold-down clamp.
      (2) Connect electrical plugs to transponders.

TRANSPONDER CONTROL HEAD - MAINTENANCE PRACTICES

1. General
   A. Maintenance practices consist of replacing defective components.
   B. The control head is located in the center instrument panel.

2. Removal/Installation
   A. Remove Control Head
      (1) Loosen quick release fasteners securing control head to instrument panel.
      (2) Remove control from instrument panel sufficiently to allow removal of electrical connectors.
      (3) Disconnect electrical connectors from control head.
   B. Install Control Head
      (1) Connect electrical connectors to control head.
      (2) Position control head in panel.
      (3) Secure control head to panel with quick release fasteners.

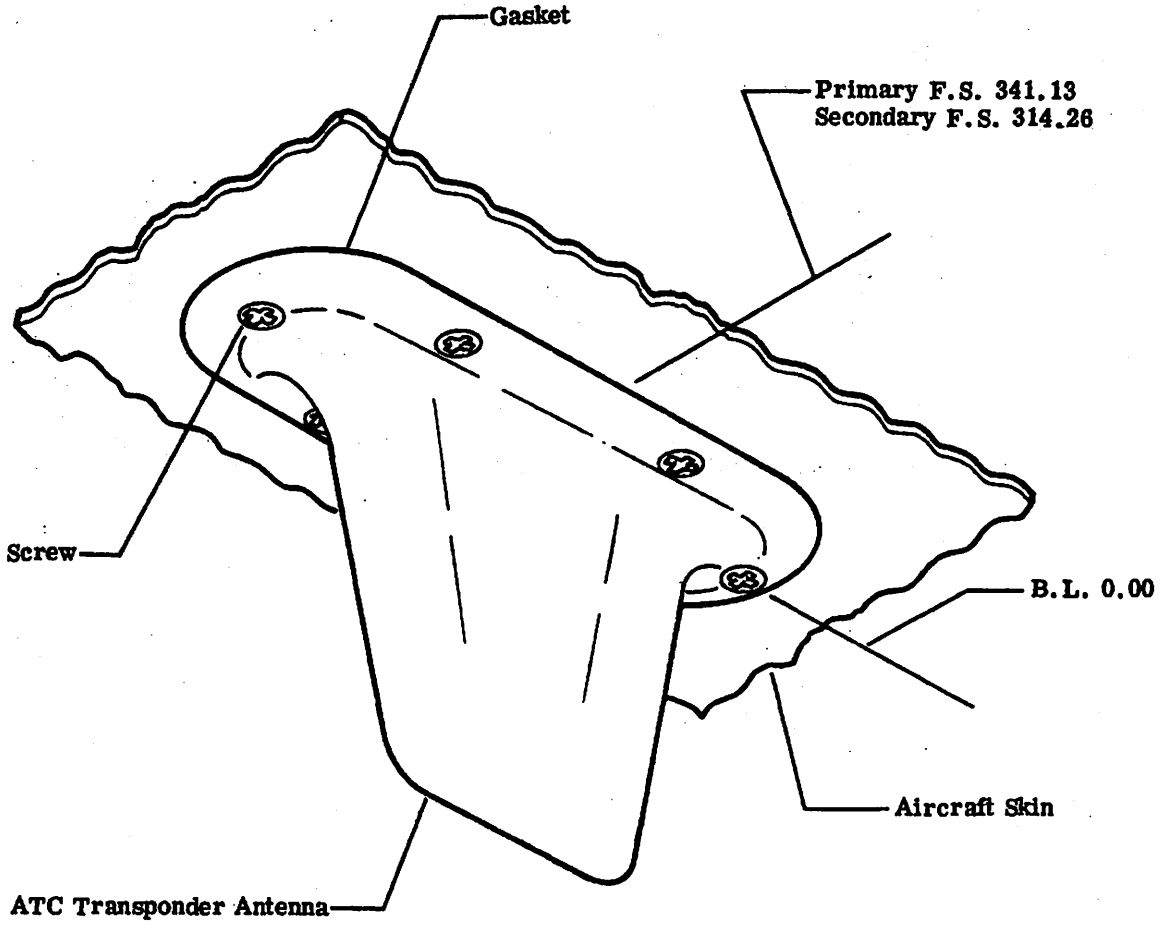
ATC TRANSPONDER ANTENNA - MAINTENANCE PRACTICES

1. General
   A. Maintenance practices consist of replacement of defective component.
   B. The antennas are located beneath the aircraft, at approximate Sta. 314.26 and 341.13.
      (1) The primary ATC transponder antenna is at Sta. 341.13.
      (2) The secondary ATC transponder antenna is at Sta. 314.26.

2. Removal/Installation

   NOTE: Removal and installation instructions are identical for both antennas.

   A. Remove Antenna (See figure 201)
      (1) Remove carpet and floorboards as necessary to gain access to antenna installation.
      (2) Disconnect antenna lead from antenna.
      (3) Remove attaching screws and antenna from aircraft.
   B. Install Antenna (See figure 201)
      (1) Install gasket and antenna on aircraft and secure with attaching screws.
      (2) Connect antenna lead to antenna.
      (3) Install floorboards and carpet.



Antenna Installation
Figure 201

GNS-500A VLF NAVIGATION SYSTEM - DESCRIPTION AND OPERATION

1. General
   A. The GNS-500A VLF Navigation System consists of a receiver/computer, a control display unit (CDU), an optional equipment unit (OEU), an antenna, a switch panel and an interface box.

2. Description
   A. The receiver/computer is installed on the RH side of the nose compartment or in the aft cabin area beneath the divan seat. The receiver/computer is mounted in a 3/4 ATR short rack and is held in place by hold down screws. Electrical connections are made when the unit is in place and secured.
   B. The control display unit (CDU) is located in the pedestal extension in the instrument panel.
   C. The optional equipment unit is installed in the aft cabin under the divan seat or on the LH side of the nose compartment. The unit is rack mounted and secured in place by hold down screws.
   D. The primary VLF antenna is installed on the lower side of the aircraft on centerline between frames 13 and 13E. When the aircraft is equipped with a dual GNS-500A VLF system, the secondary VLF antenna is located on the RH side of centerline between frames 13A and 14.
   E. The interface box is installed on the LH side of the nose compartment.

GNS-500A VLF NAVIGATION SYSTEM - MAINTENANCE PRACTICES

1. General
   A. Maintenance practices on the GNS-500A VLF Navigation System consist of removal/installation and replacement of defective component.
   B. The receiver/computer and optional equipment unit are rack mounted and secured by hold-down screws. All electrical connections are made when the black boxes are secured in place.
   C. The primary and secondary VLF antenna are secured in place by screws. The antennas are fillet sealed (refer to 20-10-00) around the perimeter of the antenna.
   D. The following functional check is for the GNS-500 Global Navigation System.

2. Tools and Equipment

NAME	NUMBER	MANUFACTURER	USE
External Power Supply	+28 vdc	Commercially available	To provide 28 vdc to aircraft.

3. Adjustment/Test
   A. Functional Test of GNS-500A Navigation System

      CAUTION: DURING GROUND TEST DO NOT ALLOW 28 VDC POWER TO BE REMOVED FROM THE AIRCRAFT, EXCEPT IN STEPS (9) AND (10). IF POWER IS OFF FOR MORE THAN FIVE (5) MINUTES, THE STANDBY BATTERY WILL BE DISCHARGED.

      (1) Locate the aircraft on the ramp clear of buildings which might interfere with receiving VLF signals.
      (2) Connect external power supply to aircraft. Do not turn power supply on.
      (3) Turn Mode Selector Switch CCW to the stop.
      (4) Assure that VLF NAV circuit breaker is open.
      (5) Turn power supply "on". Set Battery Switches and Inverter Switches to "on". Verify 28 vdc and 115 vac.
      (6) Depress the VLF NAV circuit breaker.
      (7) Set the Mode Selector Switch on the Control Display Unit (CDU) to M (manual).
      (8) Turn the DIM control fully "CW". Check that panel lighting intensity varies when the control is turned.
      (9) Momentarily pull the VLF NAV circuit breaker. Check that the panel lighting and any readouts present on the left and right

displays remain illuminated and uninterrupted during the time that power is off.

(10) This will verify that the optional equipment unit standby battery circuitry is functioning properly.

(11) Depress the "VLF NAV" circuit breakers.

(12) Turn the Mode Selector Switch to "POS".

(13) Check that the green "VLF" indicator is flashing and that the amber "DR" indicator is illuminated.

(14) Depress the "N" (North) pushbutton. Check that the letter "N" is illuminated at the right side of the Left Display.

NOTE: Depressing either the "N" (North) of the "S" (South) key clears and provides access to the Left Display. Depressing either the "E" (East) or the "W" (West) key clears and provides access to the Right Display.

(15) Enter the aircraft's present latitude into the left display in the order of degrees, minutes and tenths of minutes. Check for accuracy of entered data in the left display.

NOTE: If any portion of the entry is incorrect, depress the "BACK" pushbutton successively until the incorrect portion of the display is extinguished. Then re-enter the correct data.

(16) Depress the illuminated "ENTER" pushbutton. The "ENTER" lamp will remain illuminated.

(17) Depress the "W" pushbutton. Check that the letter "W" is illuminated at the right side of the right display.

(18) Enter the aircraft's present longitude into the right display.

NOTE: When longitude is less than 100° the leading digit will be zero and need not be entered. Leading zeroes are not entered into the displays but all subsequent zeroes must be entered.

(19) Depress the "ENTER" pushbutton. The "ENTER" lamp should extinguish indicating that the data is entered.

NOTE: After inserting latitude and longitude data, either in the initial position or any one of the nine waypoint positions, or a change of more than ten arc-minutes has been injected into the memory; the "ENTER" light will begin flashing when depressed for the second time for a latitude/longitude data entry.

NOTE: This is an indication that a "Position Reasonableness Check" is required for the latitude/longitude data just entered. The entries should be verified and if they are correct, depress the "ENTER" pushbutton again. The "ENTER" light will extinguish, indicating the system is ready for the next input.

(20) Set the display Selector Switch to "GMT/DATE".
(21) Insert the day, month and year. The information will appear in the right hand display.
(22) Depress the "ENTER" pushbutton.
(23) Insert the present GMT. The information will appear on the left hand display.

NOTE: When the actual time is equal to the time as entered, depress the "ENTER" pushbutton. Verify that the display blanks out momentarily, the "ENTER" light extinguishes and the internal GMT timer starts.

An invalid entry such as 3200 hours or the 30th of February will not be accepted. This will be indicated by the "ENTER" light flashing until the error is corrected.

(24) Turn the Display Selector Switch to the "WPT" position.
(25) Depress the "1" pushbutton. The number "1" should appear in the "WPT DEF" display.

NOTE: If latitude and longitude for any waypoint exists in the number "1" waypoint storage location, the number "1" will appear in the FR/TO display. This will occur as each of the "0" through "9" waypoint storage locations is selected. Once entered, waypoint coordinates will remain in the system until new waypoints are entered or the system is shut down.

(26) Depress the WPT DEF pushbutton.
(27) Enter latitude and longitude of the first waypoint destination. (Refer to table 1 for entries.)
(28) Depress the "ENTER" pushbutton. The "ENTER" light will extinguish.
(29) Repeat steps (27) and (28) and enter latitude and longitude in waypoint positions "2" through "9". Use Table 1 for latitude and longitude information.
(30) Depress the "0" pushbutton.

(31) Depress the "WPT DEF" pushbutton. Check that the aircraft's present position appears automatically in the left and right displays and the "ENTER" pushbutton is illuminated.

(32) Depress the "ENTER" pushbutton. The "ENTER" light will extinguish indicating that the system storage location "0" has accepted the aircraft's present location data.

NOTE: The initial leg is the direct Great Circle route between the aircraft's present position (waypoint "0" at this point in this test procedure) and the next waypoint selected (waypoint "1" in this test). This second waypoint can be any one of the "1" through "9" waypoints stored in the system memory locations during the performance of step (29) of this procedure while the system Mode Selector switch is in "M" (manual) position.

During flight an Initial Leg is the projected Great Circle path from the aircraft's airborne location at the time the pilot keys in the next waypoint data to the latitude/longitude of the new location.

In the event only Initial Leg Selection is to be checked, it is necessary that the latitudes and longitudes for waypoints "0" and "1" be entered into those system waypoint memory locations prior to proceeding with this test. However, the system will keep position in the "POS" mode without any waypoints having been defined.

(33) Set the Mode Selector Switch to "M".

(34) Depress the "LEG CHG" pushbutton. Check that the "FR/TO" Display blanks out and the "ENTER" lamp is illuminated.

(35) Depress the "0" pushbutton. The "0" should appear in the "FR" side of the "FR/TO" window.

(36) Depress the "1" pushbutton. The "1" should appear in the "TO" side of the "FR/TO" window. Check that the "ENTER" light extinguishes.

NOTE: If a waypoint for either "FROM" or "TO" is selected that has not previously been defined an "E" (EMPTY) will appear in the appropriate side of the Display and the "VOR/LOC" flag on the Course Indicator will drop into view if the "Pilot's CDI" switch is in "VLF" position.

(37) Display Selector Switch to "BRG/VAR".

(38) The Left Display should read the Initial Heading referenced to True North. The reading for this test will be "051N" ±1°.
(39) Depress the "E" pushbutton. The "ENTER" lamp will illuminate and the Right Display should display 000E.

NOTE: The "E" (EAST) key is used in geographic areas where the magnetic variation is to the east, while the "W" (WEST) key will be used in areas where the charts show a west variation.

(40) Enter the magnetic variation for the Wichita locale, i.e., E-0-0-9. Check that the Right Display indicates "009E". Depress the "ENTER" pushbutton. The "N" should disappear from the Left Display, indicating that the system is now performing with Magnetic North as its directional reference, rather than True North.
(41) The Left Display should now indicate "043".
(42) Set the Display Selector Switch to "DIS/ETE".
(43) The distance between waypoints "0" and "1" should be present on the left display. The Display should read 160.6 nautical miles for the Initial Leg set in for this test. Check that reading is within ±.1. (For any other choice than Kansas City, Mo. as the "1" waypoint of the Initial Leg check, refer to Table 1 for the appropriate distance).
(44) Set the Display Selector Switch to "BRG/VAR". Bearing with relation to magnetic north should reappear in the Left Display and Magnetic Variation should reappear in the Right Display.
(45) Depress the "E" pushbutton (or the "W" pushbutton). The "ENTER" light will illuminate.
(46) Depress the "ENTER" pushbutton. The "ENTER" light will extinguish indicating that the system has returned to a True North reference.
(47) Set the Display Selector Switch to the "XTK/SX" position. The Left Display should be blank.
(48) Operate the Pilot's CDI "VLF-NAV 1" Selector Switch to "VLF". The pilot's CDI Lateral Deviation Bar should indicate ON COURSE.
(49) Insert Selected Cross-Track flight path distance of "R6.0" nautical miles. Check the input on the Right Display.
(50) Depress the "ENTER" pushbutton.
(51) Check that the CDI Lateral Deviation Bar swings to the right almost full scale and that the Left Display reads L 0.0 nautical miles. (Cross-Track Distance)
(52) Insert a cross-track distance of L 6.0 nautical miles. Check the input on the Right Display.
(53) Depress the "ENTER" pushbutton.

(54) Check that the CDI Lateral Deviation Bar swings to the left almost full scale and that the Left Display reads "R 0.0" nautical miles. (Cross Track Distance)

(55) With aircraft on internal power, remove ground power line and shut down ground power unit. Set the Display Selector Switch to POS. Depress the HOLD pushbutton, then depress the ENTER pushbutton. Check the DR light is extinguished.

(56) The green VLF button will illuminate continuously, indicating that a sufficient number of VLF signals are being received, and have acceptable geometry to recommend the VLF system for navigation.

(57) With the VLF light continuously illuminated, operate the Flight Director Course Deviation Indicator (Pilot's CDI) switch to the VLF position.

(58) Check that the green VLF lamp on the pilot's/copilot's Annunciator Panel illuminates.

(59) Check that the VOR/LOC flag fully retracts.

(60) Depress the "NAV 1" circuit breaker.

(61) Set the "NAV 1" receiver to "on" and select a localizer channel. (Localizer channels lie between 208.1 to 111.9 MHz at increments of 100 KHz).

(62) Check that switching to a Nav "1" localizer frequency causes the Annunciator Panel "VLF" lamp to extinguish and the "Pilot's CDI" switch to drop out of the "VLF" position.

(63) Check that switching to a Nav "1" localizer.

(64) Return the "Pilot's CDI" switch to the "VLF" position. Check that the Instrument Panel "VLF" annunciator lamp illuminates.

(65) In the event the "VLF" lamp is illuminated and the VOR/LOC flag is in view, the amber "DR" lamp will be continuously illuminated and VLF navigation will not be possible. Wait for the "DR" lamp to begin flashing and perform a Quality Factor Check. (Refer to steps 68 thru 69.)

(66) Check that the display selector panel "FR/TO" Display indicates "01".

(67) Return the "Pilot's CDI" "VLF-NAV 1" switch to the "NAV 1" position.

(68) Set the Display Selector Switch to "Q/TAS" position. The Left Display will present two separate indications pertaining to the general quality of navigation possible with the GNS-500 system. The left digit of the Display should read "1", indicating that the GNS-500 system Atomic Frequency Standard contained in the OEU (Optional Equipment Unit) is operating stably. If this digit position is blank (unlit), the Atomic Frequency Standard is unstable and will have to be repaired or replaced.

NOTE: The OEU is an optional piece of equipment and may not be present in the GNS-500A system on some aircraft. If this unit is not part of the system under test the left digit will be blank.

(69) The right two digits of the Left Display indicate navigation Quality Factor by representing a number from "1" to "99". Read and record the number present for this test.

NOTE: The navigational Quality Factor is determined by: (1) The number of VLF stations being received, (2) the signal strength of the stations being received, (3), the angularity between received signals, (4) the status of the system Atomic Frequency Standard. The Quality Factor is highest when the Number "1" is presented, "99" being the lowest quality presented by the computer. Readouts from "1" to "7" indicate a navigationally capable system. Readouts from "8" to "99" indicate a system quality good enough for dead reckoning only. Numbers from "1" to "4" indicate an optimum state for VLF Navigation.

WAYPOINT	LATITUDE	LONGITUDE	DISTANCE (N. M.)	INITIAL HEADING
Wichita, (Gates) ICT	N37° 40.0'	W97° 26.2'	0	-
Kansas City, Mo. MKC	N39° 18.0'	W94° 44.0'	160.6	051°
San Francisco, Cal.	N37° 37.0'	W122° 23.0'	1185.6	278°
Atlanta, Ga.	N33° 39.0'	W84° 26.0'	679.2	107°
Monterrey, Mexico	N25° 47.0'	W100° 06.0'	724.4	192°
JFK Int'l., New York City	N40° 38.0'	W73° 47.0'	1115.0	073°
Minneapolis, Minn. MSP	N45° 08.8'	W093° 22.4'	484.5	021°
San Antonio, Tx. SAT	N29° 38.6'	W098° 27.7'	483.3	186°
Los Angeles, Cal., LAX	N33° 56.0'	W118° 25.9'	1046.6	264°
Seattle, Wash., SEA	N47° 26.1'	W122° 18.5'	1241.5	306°

Table 1

(b) Observe that the Compass Flag (COMP) is out of view after nominal time 2 minutes and that the RD-444 Indicator heading and corresponding RMI heading slave to the aircraft heading.

(c) Observe that Compass Synchronization Annunciator is either alternately showing dot and cross or that only a part of each is in view.

(d) Rotate the TARSYN 90° clockwise. Observe that the RD-444 Indicator and corresponding RMI increases heading 90° ±2°.

(e) Rotate the TARSYN 180° counterclockwise. Observe that the RD-444 Indicator and corresponding RMI decreases heading 90° ±2° from the original aircraft heading.

(f) Return TARSYN to the slaved aircraft heading.

(g) Rotate the TARSYN 10° clockwise. Observe the slow slaving of the TARSYN, indicated by the RD-444 slowly moving to the aircraft heading at a nominal 2° per minute.

(h) Hold the INC-DEC switch to DEC. Observe the fast slave of the TARSYN. This is indicated by the RD-444 heading moving to the aircraft heading at greater than 30° per minute.

(i) Rotate the TARSYN 10° counterclockwise from the aircraft heading. Observe the slow slaving of the TARSYN, indicated by the RD-444 slowly moving to the aircraft heading. Observe for nominal 2° per minute slaving rate.

(j) Hold the fast slave INC-DEC switch to INC. Observe the fast slave of the TARSYN indicated by the RD-444 moving to the aircraft heading at greater than 30° per minute.

(k) Set the FREE-SLAVE switch to FREE position. With INC-DEC switch, increase the RD-444 heading 10°. Observe that the annunciator on the RD-444 indicates null.

(l) Return the FREE-SLAVED switch to the SLAVED position. Observe that the annunciator on the RD-444 indicates a dot. The compass card shall slowly synchronize to the magnetic heading, at which time the annunciator shall indicate a null. Set the FREE-SLAVED switch to FREE position. Observe that the annunciator on the RD-444 indicates null.

(m) With INC-DEC switch, decrease the RD-444 heading 10°. Observe that the annunciator on the RD-444 indicates null.

(n) Return the FREE-SLAVED switch to the SLAVED position. Observe that the annunciator on the RD-444 indicates a cross. The compass card shall slowly synchronize to the magnetic heading, at which time the annunciator shall indicate a null.

(o) Put the FREE-SLAVED switch to FREE position. Observe that the annunciator on the RD-444 indicates null.
(p) Return the FREE-SLAVE switch to SLAVE position.

NOTE 1: When the INC-DEC switch is held in either position in either FREE or SLAVE, the RD-444 Compass Flag (COMP) appears. The COMP flag is in view before the Directional Gyro normal erection cycle is completed. Anytime the gyro is in fast slave, during AC power off.

NOTE 2: To prevent extreme bank attitudes, the computer limits the amount of roll angle commanded to a maximum approximately 30°.

(7) HZ-444 and/or HZ-454 Attitude Gyro Check

NOTE: During the check of the HZ-454 Indicator, both Pitch and Roll input data must be present for the single-cue command bar to be in view. If either signal is invalid the bar will be biased out of view.

(a) Select Standby (STBY) mode on the ZC-200 Flight Director Computer/Controller. Observe that both Flight Director Bars and the Flight Director Flag (FD) on the HZ-444 are retracted from view or that the single-cue command bar on the HZ-454 is retracted from view.
(b) Observe that the HZ-444 and/or the HZ-454 Flight Director Gyro Flag (ATT) is retracted from view after Vertical Gyro normal erection cycle is completed in a nominal 3-minutes after AC power is supplied to the TARSYN.

NOTE: HZ-444 and/or HZ-454 Flight Director Indicator gyro flag (ATT) is in view when: Vertical Gyro is in Fast Erect before normal erection cycle is completed, vertical gyro Fast Erect Switch is held ON, AC power is OFF, Vertical gyro or flight director circuit breakers are open.